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June 1960

Quarterly Journal
AMERICAN CONGRESS ON SURVEYING AND MAPPING

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The American Congress on Surveying and Mapping is a non-profit association, organized to advance the sciences of surveying and mapping in their several branches, in furtherance of the public welfare and in the interests of both those who use maps and surveys and those who make them. It aims to establish a central source of reference and union for its members, to contribute to public education in the use of surveys and maps, and to encourage the prosecution of basic surveying and mapping programs, especially those programs which are paid for, in whole or in part, with public funds.

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Editor-in-Chief
Howard S. Rappleye

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"Most of my 45 years as engineer and surveyor have been with the New York City Board of Water Supply, helping build its famed reservoir system," says Herbert Dibbell, Shokan, N. Y. "One interesting job was a preliminary surface profile for the 30-mile West Branch-Kensico tunnel of the Delaware Aqueduct.

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"The terrain was heavily wooded; promiscuous cutting was taboo. We ran a series of courses, staying close to the proposed alignment and avoiding as many obstacles as possible. Position of each transit point, with reference to alignment, was computed. Offset shots were taken from the transit points to locate the profile. Frequent checks were made against the photos and the predetermined azimuth was revised to agree. Distances and elevations were determined by stadia.

At Shokan Reservoir, which he helped plan in 1908, Herbert Dibbell levels with his Gurley Transit.

Dibbell graduates tripod leg, swings bob over to determine H. I. quickly. Pocket (right) holds bob.

"To determine angular measurements by repetition, we employed 'double azimuths'—an efficient, speedy method seldom used, I understand, by most surveyors.

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Introducing Our New President

Rear Admiral H. Arnold Karo, government administrator, engineer, scientist, author, and lecturer, is the new President of the American Congress on Surveying and Mapping for 1960.

REAR ADMIRAL H. ARNOLD KARO

As Director of the United States Coast and Geodetic Survey since August 1955, Admiral Karo has guided the Bureau's programs in support of commerce, business, industry, and the defense of the Nation as well as substantial contributions to the national scientific posture of the United States. President Eisenhower reappointed him as Director for another four-year term and he was confirmed by the Senate for reappointment on 8 February 1960.

Born December 24, 1903 at Lyons, Nebraska, where he attended elementary and high schools, Admiral Karo was graduated from the University of Nebraska with the degree of Bachelor of Science in Civil Engineering in 1923. He immediately entered on duty with the Survey where he has spent his entire professional career of almost thirty-seven years. At ceremonies held in February 1958 at Union College the honorary degree of Doctor of Science was conferred upon Admiral Karo in recognition of his international leadership in promoting scientific pursuits in surveying and charting the national domain. He is also a graduate of the Industrial College of the Armed Forces.

Admiral Karo is Chairman of the Committee on Cartogrpahy, National Research Council, National Academy of Sciences, which serves in an advisory capacity to the Department of State in matters connected with United States participation in the work of the Commission on Cartography of the Pan American Institute of Geography and History. He has taken an increasingly active part in international cartography, serving as Chairman of the United States delegation to the Second United Nations Regional Cartographic Conference for Asia and the Far East held in Tokyo in 1958. In August 1959 he was a representative of the United States at the British Commonwealth Survey Officers Conference at Cambridge, England. Following this meeting he participated, in September 1959, as a member of the ACSM delegation at the Cracow, Poland, conference of the International Federation of Surveyors.

Admiral Karo served as the 1957 National President of the Society of American Military Engineers. He is Vice President of the American Shore and Beach Preservation Association, Commerce member of the Wakelin Committee on Oceanography, and the Coast and Geodetic Survey member of the Mississippi River Commission. In this latter assignment he plays an important part in furthering the national program of developing and improving one of the great waterways of the world. He is also a Fellow of the American Society of Civil Engineers and a registered professional engineer in the District of Columbia.

Admiral Karo's long years of service in the Coast and Geodetic Survey have in-

cluded many years of sea duty aboard various ships engaged in surveying and charting the waters of Alaska, the Philippines, and along the Atlantic, Pacific, and Gulf coasts of the United States. He has commanded the major ships of the Survey fleet. In 1941, while serving as Commanding Officer of the ship *Lydonia,* Admiral Karo received a commendation from the Governor of the Leeward Islands for the excellent cooperation and good will maintained during his tour of duty in these islands of the West Indies.

During World War II he was transferred to duty with the U. S. Army Air Forces. He held various assignments, including Commanding Officer, beginning in 1943, of the Air Forces Aeronautical Chart Plant at St. Louis, Missouri, with the rank of Colonel. At the time of this assignment the plant had just been established and was not yet in full operation. As a result of Admiral Karo's administration and guidance, outstanding achievements were accomplished in organizing the plant which today is recognized as being among the most important map reproduction plants in the world. Special commendations by the Commanding General of the Air Forces and members of the Air Staff were received for work completed under his command.

Admiral Karo received considerable recognition for his important comprehensive treatise on *World Mapping,* completed during his course of study at the Industrial College of the Armed Forces. He was awarded the Philippines Legion of Honor, degree of Officer, for eminently meritorious service in the Philippines during two tours of duty there early in his career. He is a member of the American Geophysical Union, the Cosmos Club of Washington, the U. S. Naval Institute, and the American Society of Photogrammetry.

Admiral Karo resides at 6307 Kirby Road, Bethesda, Maryland, with his wife and two children, Douglas Paul and Kathryn Rosalie. His eldest son, Arnold M. Karo, received his Ph.D. in 1952 from Massachusetts Institute of Technology in physical chemistry.

₹ ₹ ₹

Berkner Elected Treasurer of N. A. S.

Washington, D. C., April 26, 1960.—Dr. Lloyd V. Berkner, president of Associated Universities, Inc., in New York City, has been elected to a four-year term as Treasurer of the National Academy of Sciences, it was announced today by Dr. Detlev W. Bronk, president of the Academy. The election took place this morning during the 97th annual meeting of the Academy at its headquarters here.

Also elected, for three-year terms, were two new members of the Council of the Academy. They are Dr. G. Evelyn Hutchinson, Sterling professor of zoology, Yale University; and Dr. Robley C. Williams, professor of virology and research biophysicist, University of California. The two retiring Councilors are Dr. Frederick Seitz, and Dr. Harry L. Shapiro.

The National Academy of Sciences is a private organization of distinguished scientists devoted to the furtherance of science and its use for human welfare. Although it is not an agency of the Government, the Academy is called upon, under its Congressional Charter of 1863, to advise the Federal Government, upon request, in all matters of scientific and technical interest.

As members of the Council of the Academy, the Treasurer and the two new Councilors will share responsibility for the general conduct of the Academy and its National Research Council, whose activities in the stimulation of research and its applications now account for an annual expenditure of more than $12,000,000. Of this amount, approximately one third is obtained by grants and contracts from private and non-Federal sources, while the remaining two thirds are derived from contracts with and grants from agencies of the Federal Government.

The American Congress on Surveying and Mapping is a member of the Earth Sciences Division of the National Research Council of the National Academy of Sciences.

The Twentieth Annual Meeting

MORE THAN 2,500 persons registered for the ACSM-ASP convention at the Shoreham Hotel, Washington, D. C. March 20–26, 1960.

The ACSM Sessions were held in the first half of the week. Thomas A. Hughes, the Convention Director, and President George C. Bestor opened the meetings with greetings and general announcements. Four of the Technical Divisions had simultaneous meetings on the first morning of the Convention. Details of these sessions will be reported under the individual division headings.

Cartography Divison

The Cartography Division contributed to three of the professional sessions and held a business meeting during the 20th Annual Meeting of the ACSM. W. Roy Nunn, Jr., Program Chairman, presided at the Cartography Division session on March 21st. Papers were presented by staff members of four Federal mapping agencies.

"Mapping the Low-Water Line of the Mississippi River Delta" was read by William Shofnos, coauthor with Bennett G. Jones. The paper described some of the physical problems surmounted by Coast and Geodetic Survey field crews in mapping this difficult terrain.

Robert J. Beaton answered the question "Can the Mariner Trust His Chart?" by discussing the merits and limitations of possible nautical chart evaluation systems. He proposed a method of assessing chart accuracy based on international hydrographic survey standards and map evaluation systems.

"ACIC Planning for Cartographic Automation," read by Gilbert G. Ferguson, summarized the status of automation, at the Aeronautical Chart and Information Center, and outlined future problems and possibilities. Charles W. Schlager, in the last paper of the session, described "An Automatic Type-Placement System" developed by the Army Map Service.

Papers by Captain Henry G. Munson, Hydrographer of the U. S. Navy, and Colonel Robert E. Herndon, Jr., Commander, USAF Aeronautical Chart and Information Center, were the Cartography Division's contributions to the Plenary Session on March 22nd. The former emphasized the extent of the nautical charting task and summarized some of the difficulties in conducting surveys for hydrographic charts. In his paper entitled "Aerospace Cartography," Colonel Herndon described ACIC activities which support the Air Force's interest in outer space. He showed slides of some of the charts and space data prepared to meet new requirements.

Rear Admiral Charles Pierce, Assistant Director of the Coast and Geodetic Survey, represented the Cartography Division at the Plenary Session of March 23rd. He discussed some of the tide measurement activities of the Survey in his paper entitled "Is Sea Level Falling or the Land Rising in S. E. Alaska?"

Granville K. Emminizer, Jr., presided at the business meeting of the Division on March 23rd. The activities of the Division, during the year ending March 23, 1960, are summarized as follows:

The Cartography Division very actively pursued its policy of bringing to its members the latest information on cartographic operations throughout the Western World.

One of the highlights of the year was the Division's participation in an international meeting held in June 1959, at Bern, Switzerland. The purpose was to develop a practical plan for continuing and expanding international exchange in applied cartography and to create the proper organizational vehicle for international cooperation. Representatives of cartographic organizations in the U. S. A., Austria, Belgium, England, Finland, France, Germany, Italy, Netherlands, Norway, Spain, Sweden, and Switzerland attended. Duncan M. Fitchet, Rand McNally & Company, was appointed by the Division as its official delegate. A copy of Mr. Fitchet's fine paper on "The Organizing Conference of Cartography," a

detailed report on the Bern Conference, was mailed to each member of the Division and to other interested members of the ACSM.

The annual Fall Meeting of the Cartography Division was held in Washington, D. C., on November 5, 1959. The program featured a lecture by Dr. Paul A. Siple, noted polar explorer, military geographer, and scientific leader of the first group of men ever to winter at the South Pole. He gave a firsthand account of the work and discoveries of the group, which may prove to be of great significance in the mapping of Antarctica. Many magnificent color slides were shown by Dr. Siple.

Copies of the comprehensive report on the two sections of the Second International Cartographic Conference, held at Evanston, Illinois, June 15–21, 1958, under the sponsorship of Rand McNally & Company, and at Washington, D. C., June 23–27, 1958, under the sponsorship of the Cartography Division, ACSM, were received from Germany, and plans for their distribution were completed just prior to the close of the year. The report, in book form, covers many technological problems and their solutions. "Must" reading for modern cartographers.

The Division's participation in the program of the 20th Annual Meeting of the ACSM has been outlined above.

At the Annual Business Meeting of the Division, March 22, 1960, the chairman announced the appointment of two Directors, W. Roy Nunn, Jr., U. S. Navy Hydrographic Office, and A. F. Striker, U. S. Geological Survey, to serve for two years beginning at the close of the 20th Annual Meeting of the ACSM. The chairman also announced the election of Robert J. Beaton, U. S. Navy Hydrographic Office, as the incoming Chairman for 1960–1961.

Control Surveys

The Control Surveys Division meeting was held in the Terrace Banquet Room at 10:10 a.m. on Monday, March 21, 1960, with Chairman Richard G. Watts presiding. Reports were first presented by various committee chairmen. James B. Small, Secretary of the Control Surveys Division and Program Committee Chairman, reported on the results of the "Questionnaire on Geodetic Surveys" sent to about 5,000 ACSM members on March 20, 1959, immediately following the 1959 annual meeting. There were 841 replies received, which is 17 percent of the total. Over 50 percent of the replies were received from the following nine states: California, Illinois, Maryland, Massachusetts, New York, Oregon, Pennsylvania, Texas, and Virginia. The greatest response was from California, which had 19 percent of the returns.

In answer to the question "What is the nature of your professional work?" 73 percent were property surveyors, 54 percent mapping, 31 percent general construction, 27 percent highway construction, and 4 percent geodetic control. The reason these percentages total more than 100 percent is that some indicated an activity in more than one field. In regard to the accuracy requirements, 19 percent requested first-order, 51 percent second-order, 39 per cent third-order. Here again the percentages total more than 100 percent because some expressed a wish for first- and second-order, for example. In regard to the spacing of horizontal control, the request was for 1.9-mile spacing in metropolitan areas, 4-mile spacing in rural areas, and 9-mile spacing in sparsely settled or open range areas.

Maps have been prepared to show the regions of requests for control and these will be valuable in future planning. A detailed report of the results of the questionnaire and the map were furnished to the Budget Bureau because of its interest in private requirements for control surveys.

There was a large attendance at the Control Division meeting. Two hundred and three persons signed the registration sheets circulated at the meeting.

Emory T. Snyder, Army Map Service, Chairman of the Membership Committee, reported on the activities of his committee. He reported that with the assistance of A. C. Kalbfleisch, U. S. Geological Survey, his committee canvassed about 150 persons in government agencies and were able to account for 27 new members.

James Buckmaster, U. S. Geological Sur-

vey, Chairman of the Research and Development Committee, reported. He discussed the advance in the automatic levels as several new types have made their appearance in the past year. Also he reported on the advances of electronic distance measuring systems and spoke of the need for portable equipment for use on towers. He also spoke of the development of the portable aluminum tower designed particularly for electronic distance measurements. This is a tower that can be moved from one site to another without dismantling. Transportation in wooded areas by helicopter has been considered. He spoke of altimeter re-design where greater increase of accuracy could be expected. Mr. Buckmaster also reported on the trend toward improvement of optics in surveying instruments.

Charles Whitten, Coast and Geodetic Survey, Chairman of the Technical Standards Committee, did not report since the work with that Committee has been completed for the present.

Professor Arthur J. McNair, Head, Surveying Department, School of Civil Engineering, Cornell University, reported as Chairman of the Public Education Committee. Prof. McNair reported on the seriousness of the education of civil engineers. He solicited the aid of all in the survey profession to encourage students to take an interest in surveying.

Next was a report by the Nominating Committee. In the absence of the Chairman, E. D. Morse, Houston Lighting and Power Company, Houston, Texas, Benjamin E. Beavin presented the Committee report. Max O. Laird, Western Electric Company, was nominated and unanimously elected Director. The Directors for 1960 are as follows:

Daniel E. Whelan, Dean of Engineering, Loyola University, Los Angeles, California;

Julius Speert, U. S. Geological Survey, Washington, D. C.;

Max O. Laird, Western Electric Company, New York.

A panel of users of distance measuring systems presented a series of short papers. Raymond W. Morton, Jr., Photogrammetric Engineer, Erdman, Smock, Hosley and Reed, Inc., Washington, D. C., spoke on the use of Geodimeter Model 4 in making engineering surveys. Carl R. Friberg, Jr., Geodesist, U. S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va., reported on the comprehensive tests that have been made on Micro-Dist. The tests made to date indicate the instrument is capable of first order precision. Hans Meier, Aero Service Corp., Philadelphia, Pennsylvania, spoke on the use of the Tellurometer in trilateration nets. One of the nets he described was near Arabia and the other in Pennsylvania. The first consisted largely of distances measured over water and other distances over land. In both surveys a large number of redundant lines were measured to provide the necessary checks and to obtain the required results.

Dr. W. A. Heiskanen, Ohio State University, Columbus, Ohio, spoke on the new era of Geodesy. He was followed by Luman E. Wilcox, Aeronautical Chart and Information Center, St. Louis, and William M. Kaula, formerly Army Map Service and now NASA. The last two speakers described the techniques that had been used by their respective agencies in establishing world geodetic systems.

During the plenary session, which was under the direction of the Control Surveys Division, representatives of the various producers and manufacturers of distance measuring systems told of the most recent developments in these instruments. R. Scholdstrom, of Stockholm, representing the Geodimeter family of instruments; Eddy Hose, Cubic Corporation, San Diego, California, representing the Micro-Dist system; and Donald D. Mears, Tellurometer, Inc., Washington, spoke on the servicing of that equipment and the latest developments in the family of instruments now available for hydrography, photogrammetry and other related fields.

Education Division

At the Business Meeting of the Education Division Professor Robert Turpin, Univer-

sity of Texas, was elected as a Director of the Division with term expiring in 1963. The other Directors are: Professor Eldon Wagner, University of Wisconsin, Chairman 1960; Professor John Eichler, Georgia Institute of Technology, 1961; and Professor Calvin Tooles, Virginia Polytechnical Institute, 1962.

A report by the Scholarship Committee stated that the Keuffel & Esser Company has offered to set up a Fellowship in the amount of $1,000, plus tuition, per year for graduate study in surveying and mapping. The Education Division asked that this offer be accepted and approved by the Board of Directors of the ACSM.

The Committee on Curriculum Study reported on its work to date, and asked for support from the Engineering Council for Professional Development and also from the Technical Divisions of the ACSM. It was decided to continue the employment study begun by the California Pilot Questionnaire. A Questionnaire Committee composed of members of the Curriculum Study Committee was appointed to continue the employment studies.

Instruments Division

There was no business meeting of the Instruments Division, and there was no election of officers. The Division was responsible for one of the plenary sessions of the convention.

Lester C. Higbee, W. & L. E. Gurley Co., presented a very interesting report of his 12-week tour of instrument factories in Europe. He visited more than 30 factories varying in size from small shops with only a few employees to the Zeiss Company, with more than 20,000 employees.

Porter W. McDonnell, Jr., Eugene Dietzgen Company, reported on the new design features of the Watts Self-Setting Level. Emile N. Bernard closed the session with a paper on scribing on coated foil and coated glass through the use of coordinatographs.

Property Surveys Division

The activities of the Property Surveys Division at the Twentieth Annual Meeting consisted of the Land Surveyors Annual National Conference (in two separate sessions), a plenary session, and a Division business meeting.

The first session of the Land Surveyors Conference, held Monday morning, featured reports from five Division committees. A sixth committee report took the form of a panel discussion presented in plenary session Tuesday morning. In his opening remarks, Division Chairman A. Phillips Bill stated that the committee reports would give some indication of the enormous amount of activity by the Division during the year.

James L. Bell, Chairman of the Fees and Salaries Committee, stated that his committee had completed its work so far as its original instructions were concerned, with the publication during the year of its 1959 report and accompanying table, but recommended that an active Fees and Salaries Committee be maintained to keep a finger on the economic pulse of the profession by advising itself of any major changes in local fees and salaries practices, and to restudy conditions in a major over-all manner once in each five-year period in the future. Prof. Paul P. Rice, a member of the Committee, presented a paper on "Basic Principles in the Preparation of Schedules of Fees." The principles outlined by Professor Rice are intended as a guide to preparing or revising schedules of fees, for use by both the Committee and any other organization or firm.

In presenting the report of the Model Surveyors' Registration Law Committee, John T. McMahon, Chairman, outlined the difficulties of preparing a model law that would satisfy the diverse requirements and take into account the extreme variations in professional standards and practices in the various States. He pointed out that the National Council of State Boards of Engineering Examiners is currently making a comprehensive study of surveying registration and related items, and suggested that the role of the committee, for the present at least, should be that of watching developments with regard to this study and of assisting various State organizations, where possible, in achieving greater uniformity and generally higher standards in State registration laws.

Victor H. Ghent, Chairman of the Ethics Committee, reported that the ACSM Professional Status Committee is studying the Code of Ethics presented to the ACSM Board of Direction last year by the Division. Mr. Ghent called on J. Sprigg Duvall of Victor O. Schinnerer & Co., Inc., who presented a paper entitled "A Progress Report on Land Surveyors' Professional Liability Insurance." Mr. Duvall outlined the scope of the coverage that is contemplated and discussed eligibility requirements and methods of establishing rates. He pointed out that the proposed policy had not yet been filed with the various State insurance commissions, with the result that the policies are not yet available, but may become available in some States during the coming year.

The Publications Committee, reporting through its Chairman, Prof. Winfield H. Eldridge, for the first time since its formation, outlined progress made on the three projects to which it is devoting attention: (1) reviewing of material for Journal publication, (2) stimulation of interest in preparation of new material for publication, and (3) the major work of preparing a comprehensive reference bibliography for property surveyors. Professor Eldridge briefly described the scope and form of the proposed bibliography and presented a tentative outline of the topical structure.

For the Committee on Legal Map Filing and Recording, Chairman W. B. Williams reported that three excellent reports on systems in use for filing plats or subdivision plans had been reviewed by the Committee. These reports covered the States of Massachusetts, Minnesota, and Texas. Mr. Williams recommended that the Committee send questionnaires to three surveyors in each State to obtain information of filing and recording as practiced in the various States. Elmer J. Peterson, the Minnesota member of the Committee, described the system in use in Minnesota resulting from the new platting law passed in 1959.

At the plenary session Tuesday morning, the committee appointed to study the surveyor's role in urban or city planning reported as a body in the form of a panel discussion. W. H. Matheny, Committee Chairman, described conditions in the Southeastern States. According to Mr. Matheny, the surveyor himself is partly responsible for the development and growth of various planning boards and commissions, because of carelessness or indifference. The surveyor, he said, is "fast being relegated to a role of subprofessional work through the political activity of the career planner." He suggested that, in order to protect his future professional standing, the surveyor must promote protective legislation, particularly with reference to provisions that assure that planning be done by persons qualified in all phases of planning, including ability to survey the property on which development is planned.

W. J. Reese of Illinois substantiated Mr. Matheny's contentions that the land surveyor can blame himself as much as anyone for the development of city planning agencies and that planners often have little knowledge of land surveying and laws pertaining to land. He concluded that surveyors must broaden their technical knowledge to include the fundamentals of good planning, and must take a more active part in city planning.

The third panelist, C. C. Lindsay of Montreal, Canada, a member of the ACSM Advisory Council, traced the development of urban planning in Canada, with particular reference to Quebec Province. Judging from his comments, the land surveyor in Canada may be in a somewhat better position with regard to urban planning than in the United States. In all Canadian Provinces, the land surveyor alone can prepare and register subdivision plans; in all the large cities, registered land surveyors occupy places in town planning departments. Mr. Lindsay presented the results of a questionnaire sent out by the Corporation of Quebec Land Surveyors indicating that, in general, the land surveyors are interested in and have an important role in town planning, but that they feel a need to broaden their training in this field.

Arthur D. Shaw, the fourth panelist, described conditions in the New York City-Long Island area. Here, he said, most of the town planning boards have consultants

who are professional engineers or land surveyors, and some county boards have land-surveyor members. Because of excellent cooperation received from the planning boards, there are no serious problems, he said, except with relation to drainage and sanitary facilities. He stated his belief that the educational requirements of the surveyor should include land planning and drainage, so that he will be better prepared to serve on planning boards as a fully qualified professional.

C. J. Aggeler, the final panel speaker, summarized his comments by stating that surveyors or engineers, whether employed by planning organizations or in private practice, "must have an understanding of all the aspects of planning, so they must supplement their education with formal or informal study of the complete problem of land planning . . . in order to be better prepared to eliminate future disagreements with planning commissions . . . ."

Continuing the Land Surveyors Conference late Tuesday afternoon, Division Secretary Victor H. Ghent introduced Division Advisors—officially appointed representatives of ACSM Local Sections and Affiliates. Nearly all of the thirteen Local Sections and the seventeen Affiliates were represented. Delegates from unaffiliated organizations were also introduced.

At the annual Division business meeting which followed, five resolutions were presented and approved. These included (1) a resolution endorsing the type of professional liability insurance outlined by J. S. Duvall in his paper, and instructing the Division Executive Committee to pursue this matter to the best advantage of the land surveyor; (2) a reiteration of resolutions presented to the ACSM Board of Direction in the past requesting that the ACSM establish a roster of membership of the Division; (3) a request that the ACSM Board of Direction urge the ACSM Public Relations Committee to investigate and formulate better methods for improving public relations with regard to the ACSM and its Sections and Affiliates; (4) a request to the Board of Direction of the ACSM that the ACSM By-laws be amended to permit the establishment of two classes of Property Surveys Division members—voting members and associate members—the distinction to be based upon whether or not the member is qualified to practice land surveying, either through registration or through demonstration of acceptable experience; and (5) a request that the Division Chairman appoint a committee to investigate and make recommendations with regard to the need for special dues for Division members.

Paul P. Rice, Chairman of the Nominations Committee, read the names of nominees for Division offices for 1960. The following were elected by unanimous vote:

Chairman—James L. Bell, Kansas
First Vice Chairman—W. J. Reese, Illinois
Second Vice Chairman—Curtis M. Brown, California

Retiring Chairman A. Phillips Bill was given a standing ovation in appreciation of his three years of service in that office.

As his first duty, the new Chairman once again reappointed the indefatigable and long-serving Victor H. Ghent as Division Secretary. Robert C. Eller was reappointed as Associate Editor.

Chairman Bell established four new committees for the coming year. The first, to be known as the Land Surveyor Education Committee, is to compile information regarding educational needs of land surveyors, to suggest means of securing the indicated curricula changes, and to assist the ACSM Education Division. A Ways and Means Committee was established to study and report on the financial and other needs of the Division and its committees, and to study the dues question. A committee was established to pursue the professional liability insurance matter as directed by the resolution on that subject. The fourth committee, the Land Surveyors Manual Committee, is to formulate a policy with respect to contents and format for the guidance of the various States in the preparation and publication of manuals dealing with the practice of land surveying. The Ethics Committee is to have a sub committee investigate the pros and cons of "sundowning" and is to try to establish National Standards

for title surveys, working, if possible, with the American Title Association. The model law study committee was changed to Legislative Committee and it will work, if possible, with the survey committee of NCBEE.

New Committee Chairman were announced by Mr. Bell as follows:

Ethics—Victor H. Ghent
Fees and Salaries—Paul P. Rice
Publications—Winfield H. Eldridge
Legislative—Curtis M. Brown
Urban Planning—W. H. Matheny
Legal Filing—To be named
Education—A. Phillips Bill
State Manual—W. Thompson Cox

Topography Division

The Topography Division session was held Monday morning, March 21, and consisted of the presentation of six prepared papers under the heading, "Symposium on the National Map Accuracy Standards." Chairman Charles W. Buckey presided.

Lloyd E. Marsden, U. S. Geological Survey, traced the path, historically, which map accuracy requirements have followed from 1912 to the present. Mr. Marsden explained how the development of photogrammetric methods for topographic mapping accelerated the need for setting up accuracy standards capable of mathematical analysis. Some of the problems encountered by the various committees appointed to study and formulate map accuracy standards were discussed, as well as the manner in which diverse opinions were resolved to produce, finally, the currently accepted June 17, 1947, revision entitled "United States National Map Accuracy Standards."

"Experience with the National Map Accuracy Standards at Army Map Service" was the title of the paper contributed by Harold E. Sewell of the Army Map Service and presented, in his absence, by Sherman L. Dietterle. Mr. Sewell pointed out that fundamentally the Army Map Service would like to prepare all their military maps in accordance with National Map Accuracy requirements but must, on occasion, make compromises due to uncontrollable factors in mapping foreign areas. Variations in acceptable standards of map requirements were pointed out as being influenced by the degree of development within certain countries, those having a greater degree of development demanding improved accuracy requirements. The Army Map Service method for obtaining test samples for accuracy tests was explained, with resultant findings used to prove the validity of methods applied in foreign operations. The Army Map Service is studying the military users' requirements for map accuracy and will cooperate in developing means for improved expression of map accuracy standards.

L. L. Funk and G. P. Katibah of the California Division of Highways acted as coauthors of a discussion entitled "Large Scale Mapping Requirements for Highway Design," with the presentation being made by Mr. Katibah. The varying degrees of map accuracy requirements in highway design were correlated to each individual design phase under consideration. The appropriateness of National Map Accuracy Standards with respect to general layout and design was explained, with refinements in accuracies required for phases involving the computation of earthwork for final design and payment to the construction contractor. Special design situations which directly affect horizontal and vertical alignments involve a high degree of point accuracy and are necessarily dependent on derivation of data by methods other than map measurement. The likelihood of a variation in map accuracy within accuracy specifications was explained, as well as some of the situations which produce this condition. Better communication between the mapmaker and the map user was suggested as a means of forewarning the map user of the possibility of these conditions.

Joseph P. Burns of Mark Hurd Aerial Surveys, Inc., discussed the "Suitability of National Map Accuracy Standards for Engineering Maps." The inadequacy of National Map Accuracy Standards when applied to large-scale maps was brought out, with an admission that satisfactory standards for the large-scale maps are extremely difficult to establish. Mr. Burns pointed

out that map clients place much faith in the reliability and judgment of the mapmakers to furnish them with a map product which will serve them best. In many instances this means that map specifications are tailored to the specific map need.

Carl J. Alster, Alster and Associates, Inc. presented as his topic "Checking Vertical Accuracy of Topographic Maps." The importance of logic and judgment when testing for vertical accuracy was emphasized by Mr. Alster. The futility of test procedures which do not consider items such as predominance of ground cover, steepness of terrain, and direction of test profiles relative to directional trend of contours was explained. An example of the dangers and added costs resulting from misunderstood accuracy requirements was given. In conclusion, the importance of selecting areas for testing that typically represent the entire project was brought out, with recommendations that test profiles be run perpendicular to the direction of the contours and that allowance be made for the permissible horizontal displacement of the contour as per the Reference Guide Outline.

Morris M. Thompson, U. S. Geological Survey, as the last speaker of the symposium, presented a paper entitled "A Current View of the National Map Accuracy Standards." The report presented five considerations affecting the National Map Accuracy Standards, including the following: (1) the need for updating the standards in terms of scientific terminology such as standard error; (2) the conflicting opinions regarding degree of accuracy required by map users; (3) a grading system of map accuracy classification; (4) reliability differentials for various portions of a given map; (5) the desirability of standardized accuracy testing techniques.

Following a brief but lively discussion period the announcement was made concerning results of the election of new Topographic Division officers for the coming year, as follows:

Chairman—Bennett G. Jones, Coast and Geodetic Survey

Director (from government)—Thomas A. Hughes, U. S. Geological Survey

Director (non-federal)—J. E. Harwood, Virginia Department of Highways.

The afternoon plenary session was launched by the Topography Division, Chairman Charles W. Buckey again presiding. The program feature was a paper by Donald B. Clement, U. S. Bureau of Land Management, titled "Progress in Cadastral Surveys." Drawing upon his lengthy experience with the Bureau, Mr. Clement described the progress which has been made in the cadastral survey of the public lands of the United States, beginning with the Act of the Continental Congress of May 20, 1785. In addition to the original cadastral survey of the public lands there is another major field of operation involving the resurvey of the public lands for the purpose of recovering and redefining the boundaries for proper administration and management. Newer methods described include that of protraction for location of township corners, a method finding success in Alaska, Arizona, and Montana. A description of the development of survey instruments used in cadastral surveys was also given, culminating in the more recently used electronic distance measuring devices.

Business Meeting

The 20th Annual Business Meeting of the ACSM was held on the night of March 22, 1960, with George C. Bestor, President, presiding. The first items of business were the reports of the various Divisions. These reports were brief and consisted of summaries of the items reported more fully under the individual Division headings above.

REPORTS OF LOCAL SECTIONS

Those representatives responding for the local section reports were: Mr. Aggeler of California; Mr. Curtis of Great Lakes; Mr. LaConte of Louisiana; and finally Mr. Hicks of Texas, who gave a very comprehensive report of their activities and invited all to the Southwestern Regional Conference to be held in Austin, Texas, next October.

SPECIAL COMMITTEE REPORTS

Mr. Moore reported on the "Merger Study of ACSM-ASP." Because of the delicate situation that arose, the Committee recommended a further two-year study of the problem after which time a definite statement will be forthcoming.

Mr. Higbee reported progress of the "Professional Status Committee" and plans have been laid to forward this work.

REPORT OF MEMBERSHIP COMMITTEE

Captain F. S. Borden reported that the individual membership of the Congress for the year 1959 was 5,202; the library membership amounted to 717, making a total of 5,919.

Net gains in individual membership can best be seen by observing the gains and losses over the past two years. During the calendar year 1958, 963 new members were added, and during the following year 992. This makes a two-year total gain of 1,955. Against these gains we have had losses from deaths, resignations, and delinquency of 750 members. Percentage wise this amounts to an average annual loss of approximately 7½ percent of the total individual membership.

Projecting these additions and percentage losses indefinitely, we find that the maximum membership attainable would be somewhere between 13 and 14 thousand members.

TREASURER'S REPORT

Captain Henry W. Hemple, Treasurer, submitted his report. Details of this report were published in SURVEYING AND MAPPING, March 1960, Vol. XX, No. 1, p. 130.

REPORT OF EXECUTIVE SECRETARY

"This report is rather sketchy, mainly for the reason that I have been so busy, tying loose ends for everybody else's report and with activities underlying this Convention, that I have not had time to prepare a report.

"In brief, the American Congress on Surveying and Mapping has this year held its first Western Conference in the Los Angeles area. That was the second Pacific conference. It was a success, as was the first one last year. At that conference we projected a meeting in 1961 in Phoenix, Arizona, in the fall, which will be another regional conference. Since then, in conjunction with the Texas Section of ACSM and the Texas Surveyors Association, we are effecting the 1960 Southwestern Regional Conference in Austin, Texas, in the fall.

"As you know, we have joined FIG, which is the Federation Internationale des Geometres, or, in English, the International Federation of Surveyors. There will be a Committee meeting of that group in 1960. The 10th International Congress, in which we will participate, will be held in Vienna in 1961.

"We have added this year the Texas society of the Texas Surveyors Association (TSA) in affiliation with ACSM. We have added New Mexico to the list of our own Sections.

"We have added Minnesota to our list of affiliated organizations. We have a total at this time of 13 Sections, 18 Affiliates, and that totals 31 organization members of the ACSM spread through 22 States of the United States.

"In addition to that, we have close contact with 8 other societies in 8 other States and therefore we have a national influence in some 30 States in the United States.

"That just about sums up the activities for the year. We have accepted the Texas 1960, Arizona 1961, and St. Louis 1962 meetings; and, as has been mentioned, the Wild Heerbrugg Award which will be reported on a little later."

(Mr. Dix further reported that the deed of the Award was informally accepted and appears in the March 1960 issue of SURVEYING AND MAPPING.)

REPORT ON FIG

The meeting in Crakow was attended by Admiral Karo, Lester Higbee, Charles Whitten, and ACSM President George C. Bestor. The president reported that some 22 nations now belong to the International Federation of Surveyors. The meeting was enjoyed by all and was very helpful in making contacts with these professional men from other countries.

The next general Congress will be held

in Vienna during the latter part of August and the first few days of September 1961. President Bestor suggested that those who plan to visit Europe the summer of 1961 make a special effort to attend this meeting and contact him before finalizing their plans.

REPORT OF TELLERS

In the absence of Mr. Graham, Chairman of the Tellers Committee, Mr. Dix reported on the results of the election:

President: Rear Admiral H. Arnold Karo

Vice President: Brother B. Austin Barry

Directors: (for two-year term) Ralph Moore Berry, Duncan M. Fitchet, Victor H. Ghent, Roland H. Moore, and Alfred O. Quinn.

Mr. Bestor, before relinquishing his office, expressed his personal feelings and thanks to his many friends who helped him make his stewardship of the ACSM a success. Mr. Bestor then handed the gavel over to the newly elected Vice President, Brother B. Austin Barry, only because the newly elected President, Admiral Karo, was unavoidably detained, and could not be present.

Brother Barry, on his and Admiral Karo's behalf, expressed words of thanks to outgoing President Bestor and to those men who have so loyally and faithfully served the ACSM through the years. The meeting ended on a note of international harmony and good will, with our neighbors to the north thanking us for a wonderful meeting and wonderful hospitality, and extending "best wishes for the coming year."

Social Activities

EDITOR'S NOTE.—As for some years in the past, we are again indebted to Mrs. Frank Borden for this report on the social activities of the 1960 ACSM–ASP Consecutive Meetings.

Aside from such eagerly anticipated entertainment as the cocktail parties, dinner, and dance, which were enjoyed by both men and women, there were many delightful activities planned especially for the latter by a resourceful and hard-working committee. As is reported each year, more and more members are bringing their families as word gets about of the really gala week in store for them.

This year nearly a hundred ladies were on hand for the "morning coffee" session held on the opening day in the Tamerlane Room. Coffee and pastries were served, and small tables were made available throughout the room for friendly get-togethers. Favors, such as miniature lipsticks, sachet, cigarettes, etc., were furnished by various advertisers. Since each guest wore a name card and, in addition introduced herself with her home town, it was discovered that there was a wide geographical range among them, and even Switzerland did not seem so far away! After an hour of animated conversations, films of Antarctica were shown by Mr. Walter Seelig of the U. S. Geological Survey who had taken these pictures of a fascinating and not-too-familiar area, and who accompanied their showing with explanatory and entertaining commentary.

Monday afternoon a tour was made of the Wax Museum, which holds an interesting collection of life-like figures of both past and present.

Tuesday was given over to an all-day sightseeing trip in nearby Virginia. Many places of historical interest were included in the tour; Gunston Hall, Arlington Cemetery, and many others. Luncheon was served at the Old Club in Alexandria, which, besides furnishing excellent food, displays many documents and momentos of an earlier era.

Wednesday, tickets were available for Look Homeward Angel currently playing at the National Theater. Many of the visitors shopped, while others took the time for further sightseeing. Bridge tables were set up in the Tamerlane Room for those who wished to remain in the hotel.

The really big event of the week was the Wednesday evening banquet, which each year attracts more people. Requests for seating poured in even after reservations were closed, but somehow the crowd of over six hundred was accommodated. The Cornish hen dinner was up to the Shoreham's standard of excellence, and the program

which followed was distinguished, as was evidenced by long and appreciative applause.

A dance duo performed some spectacular feats of strength and agility and was recalled many times. A performer on the harmonica proved himself a real virtuoso and amazed the audience with the great variety of his performances on this humble instrument. The trio of attractive young ladies who comprised the final number was introduced as a recent act on Ed Sullivan's show. They delighted with a sprightly program of songs old and new.

Interest always runs high at the time of the drawing for door prizes. The beautiful and much-coveted globe and several large plastic relief maps went to lucky ticket holders. There was a fine air of sociability about the whole evening, and knots of friends lingered about the room long after the program was over.

On Thursday morning, bridge was planned for the ladies and many tables were organized. Coffee was served, and prizes were given for high scores. Following the card games, a fine luncheon and Fashion Show was given in the Palladian Room, and the tables were well filled. Again favors were at the places. A representative of a nationally known beauty salon was present and gave a talk on proper make-up for Easter finery. This was followed by a showing of hats, large and small, which all looked very glamorous on the pretty girls who appeared on the runway. As a door prize, a lovely little hat, seeming to consist of a bunch of silver grapes artfully arranged, was won by a visitor from Switzerland.

Friday, there were guided tours of such religious centers as the newly constructed and spacious shrine of The Immaculate Conception, the always inspiring National Cathedral, and the Islamic Center. At the latter place, the visitors sat stocking-footed on the richly carpeted floor and, seeing the white-turbaned worshippers and hearing the exhortation in Arabic, felt that they were in a mystic land.

Many delegates left on Friday, but those remaining in town enjoyed the dance which is always a happy finale to a busy week which combines sociability and entertainment with hours of interesting and stimulating discussion and observations on the scientific aims of the two societies. The ladies, particularly, have agreed that science can be fun!

Exhibits

The sixth combined ACSM-ASP exhibit was officially opened at 11:00 a.m., March 22, and closed at 7:00 p.m., March 24, 1960. One hundred eighteen exhibit spaces were available, all in one area as in 1958 and 1959, and these were occupied by 70 commercial exhibits and 22 educational exhibits, with 27 exhibits occupying two or more of the spaces.

The commercial exhibitors taking part in the 1960 ACSM-ASP exhibit were as follows:

Abrams Aerial Survey Corporation, Lansing, Mich.
Abrams Instrument Corporation, Lansing, Mich.
Aero Service Corporation, Philadelphia, Pa.
Aeroflex Corp., Long Island City, N. Y.
AGA Svenska ab Gassaccumulator, Stockholm, Sweden
Ansco, Division of G. A. F., Binghamton, N. Y.
Aristo, Hamburg-Altona, Germany
Bausch & Lomb Optical Company, Rochester, N. Y.
Belfort Instrument Company, Baltimore, Md.
Bendix Computer Division of Bendix Aviation Corp., Los Angeles, Calif.
Benson-Lehner Corporation, Santa Monica, Calif.
Berg, Hedstrom & Co., Inc., New York, N. Y.
Blocher Blueprint and Supply Co., Washington, D. C.
Canadian Applied Research, Ltd., Toronto, Canada
Charles Bruning Company, Mt. Prospect, Ill.
C. L. Berger & Sons, Boston, Mass.
Cooke Troughton & Simms, Inc., Malden, Mass.
Cooper Trent Incorporated, Washington, D. C.
Cramer Dry Plate and Film Co., St. Louis, Mo.
Cubic Corporation, San Diego, Calif.
Data Instruments Division of Telecomputing Corp., North Hollywood, Calif.

DECCA NAVIGATOR SYSTEMS, INC., Washington, D. C.
DI-NOC CHEMICAL ARTS, INC., Cleveland, Ohio
DIRECT REPRODUCTION CORPORATION, Brooklyn, N. Y.
EASTMAN KODAK COMPANY, Washington, D. C.
E. I. DU PONT DE NEMOURS & CO., Wilmington, Del.
EUGENE DIETZGEN CO., Washington, D. C.
FAIRCHILD AERIAL SURVEYS, INC., Los Angeles, Calif.
FENNEL INSTRUMENT CORP. OF AMERICA, Clifton, N. J.
FILOTECNICA SALMOIRAGHI, INC., New York, N. Y.
GALILEO CORP., OF AMERICA, INC., New York, N. Y.
GEODIMETER CO., DIVISION OF BERG, HEDSTROM & CO., INC., New York, N. Y.
GEO. F. MUTH COMPANY, INC., Washington, D. C.
GRANT PHOTO PRODUCTS, INC., Cleveland, Ohio
HASTINGS-RAYDIST, INC., Hampton, Va.
HEICO, INC., Stroudsburg, Pa.
ITEK CORPORATION, Waltham, Mass.
INTERNATIONAL AERIAL MAPPING COMPANY, San Antonio, Texas
ISIS, York, Pa.
JACK AMMANN PHOTOGRAMMETRIC ENGINEERS, INC., San Antonio, Texas
J. L. DARLING CORPORATION, Washington, D. C.
J. G. SALTZMAN, INC., New York, N. Y.
KARGL COMPANY, INC., San Antonio, Texas
KELSH INSTRUMENT CO., INC., Baltimore, Md.
KERN INSTRUMENTS, INC., White Plains, N. Y.
KEUFFEL AND ESSER COMPANY, Hoboken, N. J.
KLIMSCH AND COMPANY, Frankfort Main, West Germany
KOH-I-NOOR PENCIL CO., INC., Bloomsbury, N. J.
LOGETRONICS INCORPORATED, Alexandria, Va.
LUFKIN RULE CO., Saginaw, Mich.
MONSEN TYPOGRAPHERS, INC., Chicago, Ill.
OLD DELFT OPTICAL CO., INC., Hicksville, N. Y.
O. M. I. CORPORATION OF AMERICA, Alexandria, Va.
PRECISION INSTRUMENTS, INC., Troy, N. Y.
FREDERICK POST CO., Chicago, Ill.
PHOTOGRAMMETRY, INC., Silver Spring, Md.
REPRO GRAPHIC MACHINES, INC., New York, N. Y.
RICHARDSON CAMERA CO., INC., Burbank, Calif.
ROYAL MCBEE CORPORATION, Port Chester, N. Y.
SEISCOR MANUFACTURING CO., Tulsa, Okla.
SOCIETE D'OPTIQUE ET DE MECANIQUE DE HAUTE PRECISION, Paris, France
TELLUROMETER, INC., Washington, D. C.
UNION INSTRUMENT COMPANY, Plainfield, N. J.
UNITECH CORPORATION, Clifton, N. J.
WALLACE & TIERNAN, INC., Belleville, N. J.
WATSON ELECTRONICS & ENGINEERING CO., INC., Arlington, Va.
WILD HEERBRUGG INSTRUMENTS, INC., Port Washington, N. Y.
W. & L. E. GURLEY, Troy, N. Y.
ZEISS AEROTOPOGRAPH, Munich, Germany

Educational exhibits were sponsored by the following organizations:

NATIONAL GEOGRAPHIC SOCIETY, Washington, D. C.
OHIO STATE UNIVERSITY, DIVISION OF GEODETIC SCIENCE, Columbus, Ohio
DEPARTMENT OF AGRICULTURE,
- Cartographic Division, Soil Conservation Service, Beltsville, Md.

DEPARTMENT OF THE AIR FORCE
- Aeronautical Chart and Information Center, St. Louis, Md.
- Air Photographic and Charting Service, Orlando, Fla.
- Air Research and Development Command, Rome Air Development Center, Griffiss Air Force Base, Rome, N. Y.
- Air Force Missile Test Center, Air Research and Development Command, Patrick Air Force Base, Fla.

DEPARTMENT OF THE ARMY
- Corps of Engineers, Army Map Service, Washington, D. C.
- Corps of Engineers, Engineer Research and Development Laboratories, Fort Belvoir, Va.
- U. S. Army Intelligence Center, Fort Holabird, Md.

DEPARTMENT OF COMMERCE
- Meteorological Satellite Section, U. S. Weather Bureau, Suitland, Md.
- National Bureau of Standards, Washington, D. C.
- Bureau of Public Roads, Washington, D. C.
- U. S. Coast and Geodetic Survey, Washington, D. C.

GENERAL SERVICES ADMINISTRATION
- Cartographic Records Division, National Archives, Washington, D. C.

DEPARTMENT OF THE INTERIOR
- U. S. Geological Survey, Washington, D. C.

DEPARTMENT OF THE NAVY
- U. S. Navy Hydrographic Office, Suitland, Md.
- U. S. Naval Ordnance Laboratory, Washington, D. C.

U. S. Naval Photographic Center, Anacostia, D. C.
U. S. Naval Photographic Interpretation Center, Suitland, Md.

SMITHSONIAN INSTITUTION
Science and Technology Division, Washington, D. C.

Surveyors Go to Sea

Some months ago a Los Angeles, California, newspaper gave considerable attention to the construction problems involved in laying a huge, sewage-effluent pipe out into the ocean from the Los Angeles Hyperion Sewerage Treatment Plant. Placing the 12-foot (inside diameter) pipe is a $21 million job, and one which necessitated the development of a complete new pipelaying technique and the invention of a complete new equipment rig.

What was not publicized, however, is the behind-the-scenes contribution a team of surveyors is making to the successful progress of the project. Their assignment was just as unprecedented as any other aspect of the operation, and their solution to some problems just as imaginative.

Several months ago when negotiations were in progress between the City of Los Angeles and a firm of contractors selected to undertake the multimillion-dollar project, the question of meeting one of the specifications caused considerable concern. The city insisted that the contractor lay the big pipe from the on-shore treatment plant to a point 5½ miles out in the Pacific Ocean, in a straight line. He was allowed only five feet deviation at most.

The position of each section of the pipe (they were to be floated out to the work site in 192-foot segments), was to be approved by the city before the crew could move ahead to the next position.

Chief Surveyor Benjamin Badgley agreed to supply a team of surveyors to help the construction men determine the precise location for placing each of these sections. In doing so the city assumed considerable responsibility. In order for the contractor to meet the schedule given him, he would have to lay $75,000 worth of pipe a day. His whole extremely complex and tightly scheduled operation depended upon how quickly and efficiently this team could "steer" the working barge into position and direct placement of the pipe.

On clear days, this was not a problem. Senior Survey Supervisor Henry Beitler developed a series of triangulation cut-ins, one for each 192-foot extension of the pipe into the ocean. Working from a high-order base line, 20,127 feet long, on shore, they could thus determine just where each new section of the pipe should lie and could direct the crew accordingly.

They expect to encounter a number of foggy days, however, and, during these periods, traditional optical methods would break down. Without some alternate plan, the project would have to shut down, with costly complications all down the line.

To avert this, they have brought in a Tellurometer System, an electronic device which measures distances directly by means of microwaves, much like radar. On foggy days, and as the pipe is advanced farther out from shore, they will change the triangulation system and switch to direct measurement to keep the pipe on line. The Los Angeles surveyors have precalculated the precise distance each segment of pipe should be from two other shore stations about 4½ miles apart.

A master unit (or "transmitter") is stationed on the barge; two remote units (or "receivers") can be set up at the shore stations in a matter of minutes. Knowing precisely how far the barge must be from each of these points, the survey party can direct the operation forward through fog or darkness. They will maintain communication by means of the Tellurometer's built-in, two-way radio.

In frequent tests of the electronic system, the city surveyors proved that they can attain an accuracy of about 1/10th of a foot on a three-mile line. The instrument is capable of measuring distances up to about 40 miles.

Positioning of the pipe by either technique is not a left-handed assignment. The Los Angeles parties actually work around the clock on a schedule that calls for some fast footwork to keep ahead of the construction crews. Here is an oversimplified description of their unique operation:

1. Early in the morning, before the construction men arrive at the barge, the four-man party establishes the exact location of the barge in relation to the section of pipe laid the previous day. (By triangulation or direct Tellurometer distance-measurement as described above.)

2. They sound the bottom on the offshore

edge of the barge to be sure the contour of the ocean bottom will accept the pipe. The pipe will be laid at depths up to 187 feet as it nears its terminal. Any obstructions on the ocean floor must be blasted away and holes filled before placement.

3. The pipe section arrives, floating to the site under a pontoon, and is positioned under the platform. The party tapes the distance from a pipe mounted on the pontoon to a pre-established working position on the barge directly over the line, to obtain the elevation of the invert.

4. The pipe is lowered into place. The party checks the elevation of the pipe in place. (One end of the tape is taken down to the pipe by a deep-sea diver.)

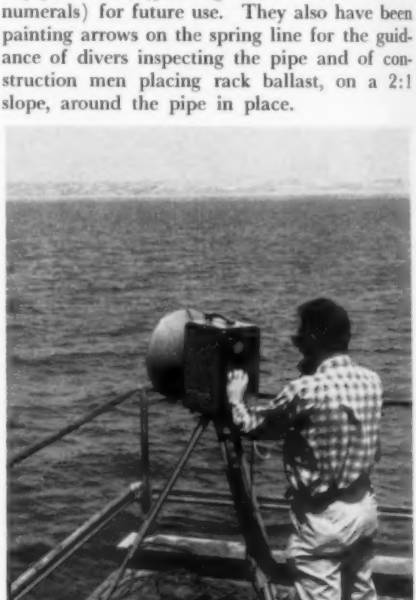
5. They are now ready to direct the equipment to its next working position. The party chief stays on the barge. The other men return to shore. One sets up a transit and light at Station "Centerline;" the other at "Inspiration Point." The working platform is lowered to the ocean surface, and the legs of the "Texas tower" are raised from the bottom a few feet until the rig floats free so it can be propelled forward. Lowering the barge to the water, moving it forward, and raising it into platform position again consumes three or four hours. The survey party directs its forward movement during this time, so that the legs of the tower will not hit the pipe.

6. After the barge has been positioned, the crew man at "Inspiration Point" turns the angle for the next day's position, and sets a sight on the beach ¼ mile away. A permanent line from this station to "Centerline," establishing a 90° angle was one of the first steps in the operation. All computations are off this line.

Meanwhile, another team of surveyors has been at work at the pipe fabricating plant 18 miles down the shore. Here they have been fixing stations every 100 feet along one side of a pipe section (painting them in with 9-inch numerals) for future use. They also have been painting arrows on the spring line for the guidance of divers inspecting the pipe and of construction men placing rack ballast, on a 2:1 slope, around the pipe in place.

Highway Information Services

Henry Beitler, senior survey supervisor for the City of Los Angeles, at a receiving station, talks with the transmitter operator on the barge, just visible about two miles offshore. The $21-million pipe will be carried nearly 5½ miles out into the Pacific Ocean to dispose of sewage effluent.



Highway Information Services

Robert Baron, surveyor for the Los Angeles Bureau of Engineering, transmits high-speed, electronic impulses from the pipelaying barge to each of two shore stations, to fix the location of the offshore line and keep it on a straight course. It takes only ten minutes to run through a series of frequencies on the Tellurometer System and determine a precise position. Baron keeps in touch with the two receiver stations on shore by means of a built-in, two-way radio.

President's Address

By REAR ADMIRAL H. ARNOLD KARO

DIRECTOR, U. S. COAST AND GEODETIC SURVEY

ELECTION to the Presidency of the American Congress on Surveying and Mapping provides me a significant opportunity to serve a great organization. As your President, I pledge my most sincere and devoted efforts in discharging the duties of the important office to which you have elected me. I realize that the Presidency of this organization is a compelling and vastly important assignment. It is a sober challenge to accomplish maximum good for the benefit of our membership in particular, and surveying and mapping in general.

In the succeeding year I shall overlook no opportunity for progressive, forward strides in improving surveying and mapping in the United States. Each succeeding year impresses upon us the increasing importance of surveys and maps in our modern civilization. Full recognition of our responsibilities as individuals as well as our collective responsibilities under the ACSM banner, provides positive incentives for a continuing program of progressive action. I hope that during the coming year we shall carry forward and multiply the excellent achievements that characterize each successive year of the Congress. As we move forward into 1960 I am sure that you share with me the realization that the coming year may be one of the most significant and perhaps the most decisive in all human history. World events to date all too clearly emphasize the precariousness of our international relations and consequently of world peace.

I was especially glad to have the opportunity of visiting various world centers in connection with my participation in the F.I.G. Conference in Poland last September. I look forward with keen anticipation to the next General Assembly of the Federation Internationale des Geometres (FIG) in Vienna, tentatively scheduled for 1961. One significant aspect of these international meetings, whether in Cracow, Poland; Cambridge, England; Ottawa, Canada; or Tokyo, Japan is the mutual understanding and good will that is invariably generated among technical people. I have found that our relations with our international contemporaries and colleagues indicate the necessity of broadening the scope of our objectives in the field of science and technology. To me this is especially true in surveying and mapping. Research and development are basic to scientific and engineering activities of the leading governments of the world, with important implications in surveying and mapping. The international conferences that I have attended during the past year or so indicate the many modifications that are made to meet specific and unique requirements, but we always find a basic community of interests that ever broadens our horizon.

As Director of the Coast and Geodetic Survey of the United States Department of Commerce, I am, of course, concerned with the problems encountered by our contemporary organizations in surveying and mapping and related fields. As members of the American Congress on Surveying and Mapping, we are concerned with the progress that is being achieved by our individual surveyors. We are also vitally interested in progress achieved by the various agencies of government as well as our great commercial mapping organizations, instrument manufacturers, and others. Moreover, we are even more sensitive to the local applications made by our members concerned with applying individual initiative and energy at the "grass roots" level. Perhaps the strongest bond among our members, other than our continuing and compelling concern with our professional standing, is the willingness to share our knowledge and experience freely. Most of our members indicate on

Presented at the 20th Annual Meeting of the American Congress on Surveying and Mapping, Washington, D. C., March 21–23, 1960.

many occasions their eagerness to exchange ideas on progressive techniques and developments basic to united progress of the sciences of surveying and mapping.

Recent advancements in the application of scientific and engineering discoveries provide the surveyor and mapmaker with vastly improved new tools and techniques for accomplishing his work. Perhaps the utilization of the velocity of the propagation of sound and electronic waves is among the outstanding achievements pertinent to surveying and mapping, which, coupled with modern photogrammetry, give the present day surveyor unexcelled tools to work with.

I should like to pay tribute to the diligent and dedicated leadership that the Congress has enjoyed since its inception 22 years ago. Our collective success has resulted from the intense application of unique abilities and energies of the past leaders of this organization. Without exception, they have been dedicated unselfishly to the best interests of surveying and mapping. During these years we have seen progressive advancement in the knowledge, professional standing, and improved quality of surveying and mapping in the United States. This combined support is the basic factor in maintaining the best standards and traditions of our profession. We have a right to be proud of our contributions and achievements.

Among my principal objectives for the ensuing year is to encourage the fullest possible increase in our membership. Our local sections are increasing in importance and numbers. I hope that our membership committee will be the busiest group represented in our official efforts during the year. The strength of numbers dedicated to a common objective is a concrete way to increase the effectiveness of the Congress and to insure a broadening of our objectives throughout the national economy.

I propose for us new emphasis on the need of a progressive public relations program. It is incumbent upon us to spell out our services and contributions to the people of this Nation. My firm belief is that the first approach to this problem is through mutual respect and friendliness among ourselves. If our daily relationships are conducted with good will and a high sense of moral integrity, professional competence, and willingness to contribute our best efforts toward fulfilling our common objectives, then our organization will be assured of a sound and efficient basis of operation. Our task is to inform the citizens of this Nation of our dedicated and unselfish services and demonstrate our intentions of continuing the traditions that now identify the American Congress on Surveying and Mapping.

So, with enthusiasm and confidence I commend you, the membership of this organization, to a program embarking us upon a new period of efficient and progressive service which will be made more dynamic by raising our standards of performance and accomplishment. We must be ever alert to ways and means of increasing our usefulness and ability to serve the American people.

Washington's Survey Office Restored

In fitting tribute to George Washington the Surveyor, a group of civil engineers from the Nation's Capital, with Director Daniel B. Ventres of the American Society of Civil Engineers, attended the dedication of the George Washington Survey Office at the Ferry Farm in Virginia, not far from Washington, D. C.

Ceremonies on February 20, 1960, were sponsored by the George Washington Boyhood Home Restoration, Inc., a voluntary group pledged to restore Ferry Farm, where Washington lived between 1738 and 1752, and where he learned to survey and established a survey office. During those years, in 1749, George Washington was examined by the faculty of the College of William and Mary acting by Charter of 1693 as Surveyor-General of Virginia, and was licensed as a Surveyor—the first Professional Surveyor in Virginia. This great Surveyor was to become *first* in many things, including *in the hearts of his countrymen.*

Celestial Frontiers

By GEORGE H. CLEMENT

THE RAND CORPORATION, SANTA MONICA, CALIFORNIA

IN ACCEPTING the honor you have given me by extending the invitation to address this joint meeting of the American Congress on Surveying and Mapping, and the American Society of Photogrammetry, I have selected the title "Celestial Frontiers," since it is well known that surveyors and mappers are more than casually acquainted with the celestial sphere. Many of you are knowledgeable of, and indeed some have made important contributions to the science of celestial mechanics, as well as to the practical applications of astronomy to surveying and navigation.

Perhaps I should assure you at the outset that I do not intend to delve into the theological or the more abstract philosophical connotations which the title of this paper might suggest, except to say that I am mindful of the growing import of space developments on the expanding sphere of human relations.

As an engineer, however, I do intend to say first something about what my professional group owes to yours, secondly what rate of progress we might reasonably expect in probing our celestial frontier, and thirdly remind you of the opportunities—the challenges—to both your profession and mine for contributing even more in the future than we have in the past to our aero/space developments.

On the first point—my own pleasant surprise at the truly remarkable precision achieved in the knowledge of the size and shape of the earth by your profession, well before the time we aeronautical and space engineers seriously entered the field, is only typical of that shared by all of us who like to class ourselves in that now honorable, but small group of FSBS's (For Space Before Sputnik). We had the pleasure of discovering and becoming well acquainted with the works of such stalwarts as Moulton, Jordan, Helmert, Bessel, Clarke, and their modern counterparts. In developing our earliest plans for space activities we realized the great debt we owe to your profession, and I am happy to record it here. More specifically, the achievements of geodesists, astronomers, and surveyors based on careful work painstakingly accomplished over the past century have given us, as space planners, the sound basis for reliable and precise orbital calculations and control. Without this substantial foundation even some of the first contributions of satellites to man's store of scientific information, to his enhanced understanding of the size and shape of the earth, would not have been possible. Yet, just as the foundations of great engineering structures are often overshadowed or hidden by the spectacular buildings they support so also does the dependable geodetic foundation for our space needs tend to be hidden.

For example, the 75th meridian tracking "fence" extending from Blossom Point, Maryland, to Antofagasta, Chile, was promptly and accurately established through the good offices of the Inter-American Geodetic Survey, a clear first in the field of international cooperation in space activities. This Minitrack fence today forms an integral and vital part of our growing worldwide space tracking net and was made possible by the work of the Inter-American Geodetic Survey during the past decade in extending the South American triangulation to complete the continuous arc from Point Barrow, Alaska, to the southern end of South America.

Likewise, the east-west space surveillance fence, stretching across the United States

Presented at the ACSM-ASP General Assembly, Washington D. C., March 23, 1960.

AUTHOR'S NOTE.—Material on which this paper is based was developed during the period the author was on the staff of the National Aeronautics and Space Administration.

from Georgia to California rests on the firm foundation of geodetic control provided by the Coast and Geodetic Survey.

Future space craft will be guided more accurately and more reliably because of the previously established geodetic networks which will make possible accurate world-wide radio command and guidance systems.

In addition to demonstrating an almost insatiable appetite for ever increasing levels of geodetic and cartographic precision, our growing space technology offers considerable promise of a host of practical and important benefits to surveyors and mappers. I shall have more to say about these benefits, opportunities, and challenges later.

However, we must not let our zeal for the promise of good things to come or our impatient desire to reap the benefits offered by our growing space capability blind us to the very real, practical, and immediate problems that confront us in attaining these goals. At the heart of most of these problems is the rocket vehicle and its associated communications, tracking, and guidance equipment. The rocket vehicle is the essential transportation device for any kind of space activity. It is therefore useful to look briefly at its history, its current status, and its effect on the development of our own space capabilities.

Man's first expression of his conscious desire to engage in space travel is certainly not of recent origin. In fact, the early history of speculation on voyages beyond the bounds of the earth closely parallels the development of concepts about the nature of the universe. As early as the second century Lucian described voyages to the moon, while Kepler speculated on such matters in his "Somnium" published in 1634.

These speculations were first given technical substance and growing hopes of fulfillment at the close of the nineteenth century as the result of work on the dynamics of bodies of variable mass and the principles of rocket flight by the two now-well-known Russians, Meshcherskii and Tsiolkovskii. There soon followed, independently, the pioneering work on rockets by Goddard in the United States and Oberth in Germany. In the course of time this pioneering activity attracted the interest of additional workers and, beginning in the late 1920's, led to the forming of private technical and scientific groups whose purpose was to cooperate in the systematic study of the new rocket devices. In this early period the work proceeded more or less independently in the three countries and involved little contact between the groups working in the field. During the 1930's and early 1940's the rocket art had progressed to the point where its military potential became apparent, and this led to the establishment of substantial Government-sponsored research programs in Germany, Russia, and the United States.

By the early 1940's, but only after the expenditure of considerable effort over a period of some 10 years, the Germans achieved the development of the first practical, automatically guided and controlled rocket vehicle. This was the V-2, a military rocket of about 200 miles range, and it was a major event in the advance of rocket technology. At the close of World War II, both the United States and Russia moved to exploit and further develop the German achievements in rocketry by instituting programs that led to the development of rocket vehicles for use as intercontinental missiles and later adapted these for use as boosters for space vehicles.

During the interval from 1945 to the present time, the state of the rocket art in the United States advanced materially in a number of respects. Figure 1 illustrates this gain in rocket vehicle performance. Today's state of the art makes possible moderately-sized, single-stage, rocket vehicles which are capable of ranges more than three times greater than the maximum possible in 1950 and over six times greater than the maximum attainable in 1945.[1,2,3]

Rocket engines have been improved to the point where 95 percent of the performance theoretically attainable is representative of current practice compared to an efficiency of less than 85 percent in 1945.[1] Multistage rocket vehicles have been developed which have the thrust and endurance necessary to propel payloads over intercontinental distances, an improvement in

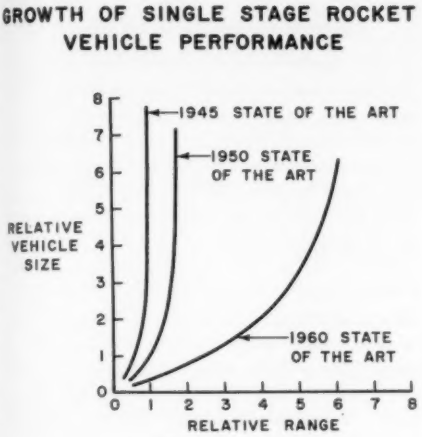


FIGURE 1.

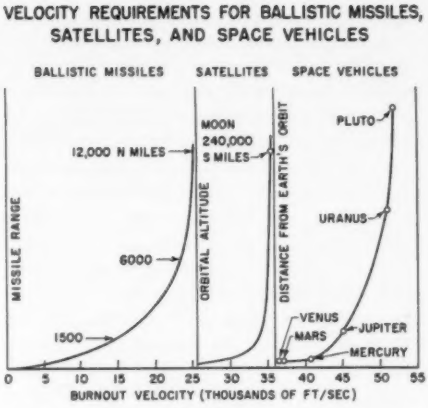


FIGURE 2.

range by a factor of 30 over the performance attained with the V-2. Improved materials, design techniques, and component miniaturization have reduced the percentage of the rocket vehicle's weight that must be devoted to its structural skeleton and related dead weight by more than a factor of three, from 25 percent for the V-2 down to about six or eight percent for current vehicles.[2] This reduction in the fraction of the rocket vehicle which must be dead weight enables a rocket of a given size today to carry heavier payloads to greater distances than was previously possible.[3] These are substantial technical achievements and have resulted in rocket vehicles which have impressive capabilities, such as the IRBM and ICBM, and now familiar Jupiter, Thor, Atlas, and Titan.

The ballistic missile programs, in addition to providing us with the technological basis for a substantial military capability, also have given us the beginnings of an adequate technological basis for the exploration of our celestial frontier. Here I want to emphasize the word beginnings, principally because in many ways a higher level of performance is required of the rocket vehicle for even the most rudimentary space mission than for ballistic missile use. The velocity performance required of ballistic missiles, satellites, and space vehicles is shown in Figure 2.[2] The greater velocities required by satellites and space vehicles, compared to ballistic missiles, results in the need for more complex vehicles employing a greater number of stages. While the ballistic missile can, and has been used, as the booster stage for space vehicles, properly proportioned upper stages are also needed to exploit the capabilities of the combination. The flight durations of space vehicles are much longer, putting even more stringent demands on the life of space vehicle components. Guidance and control performance levels acceptable for ballistic missiles fall short for some space missions. Controlling the rocket vehicle cutoff velocity to one part in 35,000 will give an impact error at the target of less than one mile in a 6,000-mile missile, but would miss Venus by more than 25,000 miles on a ballistic shot at her![2]

We have made good use of the rocket vehicles and components available from the ballistic missile program in our first two years of space exploration and will continue to do so. But it is important to recognize that at this time space activity calls for hard and clever engineering developments that are not yet, in my view, generally appreciated. I also feel that this will remain so for some time to come. We are still very much in the tooling-up phase, where the immediate objective is an efficient and reliable rocket vehicle. If we are to engage in space activities on an effective basis, it must be

expected that this development of the essential tools of the trade will require a considerable expenditure of resources in terms of funds, manpower, and time.

The first formal step taken by the United States toward the establishment of a program of space exploration was the announcement in 1955 that the President had approved plans by this country for going ahead with the launching of small, unmanned, earth-circling satellites as part of the United States' participation in the International Geophysical Year. In carrying out these plans it was decided to do the work on the smallest significant scale—more as a demonstration of the feasibility of such activity than as a real start toward a substantial program for the exploration of space.

The dawn of the space age really broke on October 4, 1957, when the Russians placed man's first artificial satellite in orbit around the earth. Since that time the United States has placed 14 satellites in orbit and the Russians an additional two. Further, the United States has launched a series of four deep space probes and the Russians three, with the more spectacular achievements credited to the Russians. In terms of meritorious and substantial scientific results, however, history may well record the 14 satellites and four space probes launched by the United States as the more important.

I have already mentioned the improved value for the oblateness of the earth obtained from our satellite data. In addition, our satellite and space probe experiments have led to a better understanding of the propagation characteristics of the ionosphere and its electron density distribution. They have added to knowledge of the earth's magnetic field; they have given us detailed information on cosmic radiation as a function of time and position in space; and they have discovered and roughly outlined the radiation belts that surround the earth. However, even though we have had many successes and have produced much valuable scientific information, our space shots have been overshadowed by the "firsts" and the payload size of those of our only competitor.

The Soviet space exploration program was presumably formally organized in 1954 with the formation of their Interdepartmental Commission for Interplanetary Communication.[4] The course of events since then has proved beyond all doubt that their initial planning called for an aggressive space program which would fully exploit the capabilities of their rocket boosters in the most dramatic fashion possible. In essence, they chose to bypass the small-scale, feasibility demonstration which was our initial step. It has been rightly said that ". . . the side that has the more advanced technology in the way of payload capabilities, guidance, and the like will have the distinct edge . . ."[5]

At the present time our national program of space exploration has two parts: first, the use of interim vehicles created on a short-term basis for the limited uses they permit, and second, the development of more versatile and powerful vehicles to provide the basis for a sound program over the long haul.[6] Both of these activities are essential. But maintaining a proper balance between these two is one of the more serious problems facing our nation's space planners today.

To satisfy our immediate needs for space vehicles we are making use of the small, upper-stage rockets developed for the Vanguard and Jupiter C programs in combination with the IRBM and ICBM vehicles of our military ballistic missile program as boosters. While the resulting vehicle does give us some small capability for beginning to explore our celestial frontier, it by no means exploits the full potential of our IRBM and ICBM rocket vehicles.

The largest scientific payload we have placed in orbit up to the present time is the 142-pound Explorer VI payload launched by a Thor-Able vehicle. This Thor-Able was a space vehicle made by combining a Thor IRBM booster stage with two small, upper-stage rockets derived from the Vanguard program, making in all a three-stage vehicle. Somewhat larger payloads have been placed in orbit by the Discoverer satel-

lites of the Department of Defense. However, at the present time, these moderately larger payloads are possible only in low-perigee, short-lived orbits which are generally not well suited for many space-science experiments.

One useful index of the efficiency of a rocket vehicle is the ratio of its gross takeoff weight to its payload weight. In the case of Explorer VI the ratio is about 750 to 1. On the other hand, as Dr. Homer J. Stewart of the National Aeronautics and Space Administration points out, a properly proportioned three stage vehicle using current levels of technology could have a takeoff-weight to payload-weight ratio of the order of 40 or 50 to 1.[6] On this basis, our present Thor IRBM as a space-vehicle booster is less than 10 percent effective, not because of its size as a first-stage booster rocket, but because we do not now have the properly proportioned upper stages to go with it. The same situation controls the present use of ICBM boosters.

To meet this current deficiency we are now developing two, new, upper-stage rockets, the Agena B and the Centaur. The latter uses a high-performance, liquid-hydrogen and liquid-oxygen, propellant system and is expected to achieve takeoff-weight to payload-weight ratios of the order of 30 to 1, a factor of twenty-five better than we have been able to accomplish to date. We are also developing the Saturn, a multistage rocket vehicle roughly four times the size of the Atlas ICBM. The anticipated growth in size of United States satellite vehicles is shown in Figure 3. By 1967, on this schedule, we should be able to launch a satellite having a gross weight in excess of 50,000 pounds, over 350 times the size of Explorer VI, our largest scientific satellite to date.

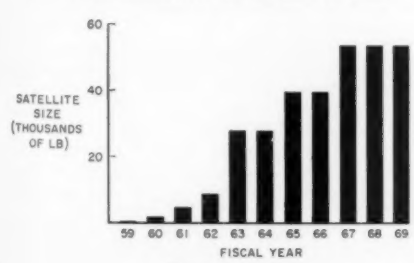


FIGURE 3.

Neither the Centaur nor the Saturn have as yet had their first flight. In fact, of the multistage, space vehicles flown by the United States up to February 1960, only Vanguard and Discoverer have test histories of nine or more launchings. In interpreting this fact it is well to recall that the Germans expended more than 1,000 vehicles during the course of the development of the V-2. It is true that we have improved the state of our rocket-vehicle technology and our testing and development techniques over the fifteen years from 1945 to the present time; but there is no escaping the fact that the development of big rocket vehicles is an engineering task of truly monumental proportions. That it can be done, and done well, has been proved beyond a doubt by our highly successful IRBM and ICBM development programs—but experience also proves that an extensive, flight-test program is an integral and necessary part of the job and the only way to get adequate reliability. Referring to Figure 4,

NASA SPACE VEHICLE LAUNCHING PROGRAM

FISCAL YEAR	1960*			1961			62	63	64	65	66	67	68	69
REDSTONE			1	2	3	2								
ATLAS			1	2	1	2	1	6	1					
JUNO II		1		1	3									
THOR-ABLE		2												
ATLAS-ABLE			1	1										
THOR-DELTA		1	1	1	2	1	1	5						
SCOUT			4	2		2		6	6	6	6	6	6	6
THOR-AGENA B								1	6	6	6	6	6	6
ATLAS-AGENA B						1		3	4	5	6	3	12	12
ATLAS-CENTAUR							1	5	4	5	6	9		12
SATURN								2	2	3	4	4	4	4
NOVA TYPE													1	2
TOTAL	12			29			28	23	25	26	28	28	29	30

*LAST TWO QUARTERS ONLY

FIGURE 4.

which is the space-vehicle, launching program for the next 10 years as presented to the Congress by the NASA last month, it can be appreciated that it will be several years before we can reasonably expect to have achieved the level of rocket-vehicle performance and reliability necessary for a significant national advance.

Figure 5 outlines the Space Administra-

NASA MISSION TARGET DATES
CALENDAR YEAR
1960
FIRST LAUNCHING OF A METEOROLOGICAL SATELLITE
FIRST LAUNCHING OF A PASSIVE REFLECTOR COMMUNICATIONS SATELLITE
FIRST SUBORBITAL FLIGHT OF AN ASTRONAUT
1961
FIRST LAUNCHING OF A LUNAR IMPACT VEHICLE
ATTAINMENT OF MANNED SPACE FLIGHT, PROJECT MERCURY
1962
FIRST LAUNCHING TO THE VICINITY OF VENUS AND/OR MARS
1963–1964
FIRST LAUNCHING OF UNMANNED VEHICLE FOR CONTROLLED LANDING ON THE MOON
FIRST LAUNCHING ORBITING ASTRONOMICAL AND RADIO ASTRONOMY OBSERVATORY
1964
FIRST LAUNCHING OF UNMANNED LUNAR CIRCUMNAVIGATION AND RETURN TO EARTH VEHICLE
FIRST RECONNAISSANCE OF MARS AND/OR VENUS BY AN UNMANNED VEHICLE
1965–1967
FIRST LAUNCHING IN A PROGRAM LEADING TO MANNED CIRCUMLUNAR FLIGHT AND TO PERMANENT NEAR-EARTH SPACE STATION
BEYOND 1970
MANNED FLIGHT TO THE MOON

FIGURE 5.

tion's program for exploring our celestial frontiers during the coming decade. I think we can feel the professional challenge it presents to us all. All of the activities listed depend in substantial measure upon precise geodetic and cartographic information.

On the other hand, satellites and space craft offer the promise of new and valuable techniques for extending our knowledge of the shape and size of the earth. Vanguard I has already contributed a more accurate value of the polar flattening of the earth, making possible a better reference ellipsoid for a world geodetic datum. In addition, the Army Map Service has been making observations on this same artificial celestial body to aid in a more precise location of islands in the Pacific.

The adaptation of photogrammetric techniques to satellite applications opens an intriguing possibility of areal inventory of resources and surface conditions. Such inventories could perhaps be helpful to wide regional surveys of several kinds: the seasonal advances and retreats of snow cover, ice movements in the oceans, perhaps even ground-cover vegetation, and so on.

The value of many of these potential tools is not yet clear and will not be until more actual experience has been obtained with the devices now in development. At present, the main obstacle in testing the worth of these new techniques lies not so much in the satellite-borne devices, but in the availability of launching vehicles having adequate performance and reliability. But it can be predicted with confidence that as soon as adequate launching vehicles do become available, many surveying and mapping uses will be made of them.

The aerial camera has not only contributed to rapid advancement in topographic mapping and charting, but has also aided the discovery of a multitude of hitherto unknown, geological features from the physiography thus made visible. It is not beyond possibility that the wider views afforded from satellites will also reveal important additional geological features yet unrecognized.

In laying plans for leaving the earth to explore our nearest celestial companion, we already feel the need for topographic maps of the moon. Without some better maps, we will be handicapped in any kind of lunar exploration—manned or unmanned; likewise, with any exploration of the nearby planets. These more distant ventures offer to surveyors and mappers a challenge even more exciting, and, I might add, even more exacting than those traditionally met by their professional predecessors who have always pioneered into unknown regions.

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Instructional Films in Surveying Education

By G. R. SHAW

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As the requirements of Civil Engineering Education have broadened, it has become necessary to find space in the four-year curricula for the introduction of new areas and new developments is existing areas. Consequently, the time alloted to courses in areas previously considered highly important has had to be curtailed.

The trend is to emphasize background courses of basic principles and reduce or eliminate courses which deal fundamentally with the application or art of engineering. In Civil Engineering curricula, the most severe inroads have been made in the area of Engineering Drawing and in the Surveying courses. With greatly reduced time available, the problem of how to provide adequate instruction in these areas is difficult to solve.

In many engineering schools the field procedures, the organization of the work program, the recognition of instrument limitations, and the proper coordination of instruments, procedures, and personnel have been acquired by Civil Engineering students during summer practice "camps." These practice sessions have, in most cases, disappeared from the curricula. Employers of our future graduates must recognize this trend, and provide in-service experience to span this void before they can expect the present graduate to take over many of the field operations for which former graduates were qualified.

Most people agree that the best way of learning is by doing. However, if there is no time for doing, many educators ask, what is the next best approach?

In answer, Rensselaer Polytechnic Institute has inaugurated a program of instructional film production in several areas—Chemistry, Drawing, and Surveying. This program has been made possible by grants made for the establishment of a department whose objective is to aid the faculty by research studies of methods which will produce more efficient and effective instruction. This department, known as "Project Reward," has developed a studio capable of producing all types of visual presentations, utilizing such media as slides, motion picture, and closed-circuit television.

The Civil Engineering Department has planned a program in cooperation with Project Reward to produce a series of surveyor-in-action films to demonstrate operations which, because of time and space, cannot be included in the remaining practice sessions. Films have also been planned to show operations with equipment too expensive to maintain as demonstration equipment; these will treat special areas of application such as electronic distance measuring and optical tooling.

The tentative list of these operations is as follows:

1. The use of an Optical Reading Theodolite for Second Order Triangulation
2. The Measurement of Triangulation Angles With a Repeating Type Instrument
3. Traversing with the Subtense Bar
4. The Establishment of a Meridian by Astronomic Observations
5. Base Line Measurement
6. Traverse Distances Using Marking Tables
7. The Use of the Tellurometer for Distance Measurements
8. First Order Triangulation with the T-3
9. Optical Tooling Equipment and Installations

These films will be produced through cooperative efforts of the staff of the Civil Engineering Department and personnel of Project Reward. The author has been the Civil Engineering advisor on the first two

FIGURE 1.—The principals hold a conference at the site of the filming.

productions. Mr. Charles Werberig has directed the photography and supervised the production for Project Reward.

Figure 1 shows a conference in progress relative to some detail of the photography at the site at which the first of the series was filmed.

The use of animation, extreme closeup shots, and split-frame technique synchronized with the narration has contributed to the interest-factor in these films. The split frames showing such features as the instrumentman pointing the theodolite and an animated view of the cross wires moving on to the target at the same time have proven to be effective.

Figures 2, 3, 4, and 5 are reproduced from the film showing the optical reading theodolite and illustrate some of the techniques used.

At present, (November 5, 1959) the first of these films has been completed, and the second is in production. It is intended that these films will be detailed operational films to supplement the lectures in each area. It is proposed that a continuous type of projection will be used, and each film will be set up as the material is currently being discussed in lecture, so that small groups of students may view the film and rerun it as many times as they desire to fully understand its content.

The evaluation of the effectiveness of any such procedure is difficult. The first completed film, depicting the operation of the Wild T-2, was shown to the students in the Advanced Surveying course during the Spring term of 1959. A questionnaire, distributed after the film presentation, included questions dealing with the actual techniques shown and also general opinion questions.

Seven questions dealing with the details of techniques were answered correctly by an average of 80 percent of the students. All students viewing the film reported that the film helped them to some extent to understand the procedure shown. Thirty-four percent of the students reported that they had been helped to a high degree by the film.

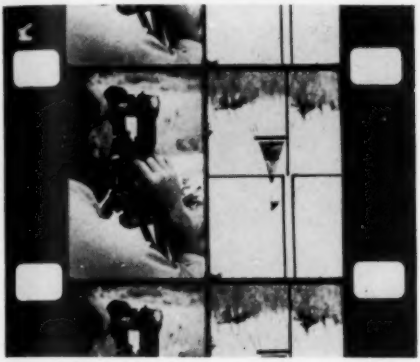

FIGURE 2.—Pointing on the target.

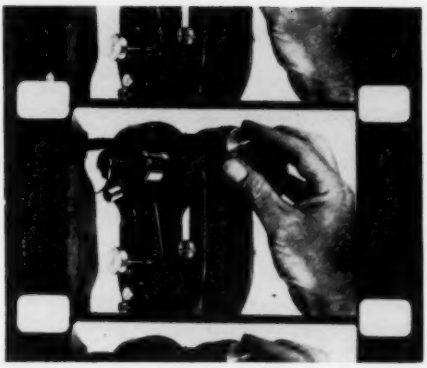

FIGURE 3.—An extreme close up during the process of reading.

FIGURE 4.—Bringing about coincidence during the reading of the circle.

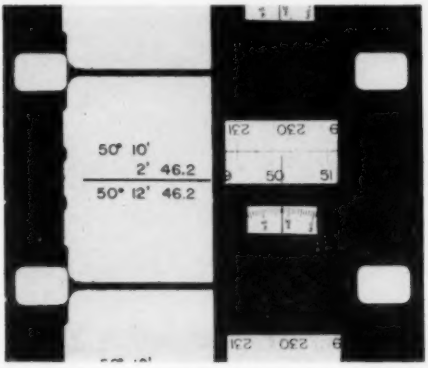

FIGURE 5.—An analysis of the steps in reading the circle and micrometer.

Having seen this film only once, this group of students was asked if they believed a repeat showing would help them further to understand the operations. To this question, eighty-four percent indicated that they would gain by a repeat showing.

Other questions dealt with the film presentation itself, and several student criticisms have been used in making a revised version of the film, which is now complete and ready for distribution.

As a result of this limited testing, two assumptions seem to be verified. The first is that the film adds to the general knowledge gained from the course as presented. The second is that the use of a continuous-type projector available for repeated viewing by the students would further increase the efficiency of film utilization.

There are many schools of Civil Engineering which have the same problem of reduced time being available for Surveying instruction. These films are, therefore, being produced with the intent of making them available for distribution to other schools and are not being made exclusively to fit a given course at Rensselaer. It is also believed that some of the proposed series, when completed, would be of value to groups other than educational institutions.

The film method of instruction in the use of instruments will certainly do nothing to

develops that instrument-man squint or the gleam in the eye by which the Surveyor can be recognized, but it is hoped that the end product will be better than could now be obtained without the telescoping of time and space that the medium of film provides.

Land Surveyors Division of the New Jersey Society of Professional Engineers

The Land Surveyors Division of the New Jersey Society of Professional Engineers conducted another successful conference at University Commons, Rutgers University, New Brunswick, New Jersey. The 20th Annual Conference was attended by over 275 surveyors from New Jersey, New York, and Pennsylvania, including some of the engineering students of the University.

The conference committee, headed by Chairman William L. Wissing, assisted by Leo Nardini, D. A. Miniaci, and M. A. Canger, Jr., provided an excellent program of speakers and items of interest to the surveyors. Thornton Garlick, Corresponding Secretary of the Division, coordinated all committee duties. Twenty-two exhibits of the latest surveying equipment, instruments, drafting supplies, and mapping techniques held the attention of all present for an interesting two-hour period.

Associate Dean Maurice T. Ayers of the College of Engineering, Rutgers University, extended a warm welcome to those present. He announced that, as a result of the passage of the recent College Bond Issue by New Jersey voters, the Engineering College will eventually move to the University Heights Campus. Ground for the new building will be broken next July.

President Edward B. Kirby of the New Jersey Society of Professional Engineers also greeted the surveyors and reported that the Constitution and Bylaws proposed for the new Land Surveyors Functional Section were being reviewed and that the section should be operational in the near future.

Division Chairman Ted C. Frank introduced Executive Director Charles Dodge and Miss Ruth Wenzel of the N.J.S.P.E. headquarters and officers and chapter directors of the Land Surveyors Division.

Professor Paul Hartman, P.E. & L.S., of the Department of Civil Engineering at the College of the City of New York delivered a paper on "The Place of Optical Instruments in Land Surveying." Professor Hartman pointed out the increasing influx of European precision instruments on the American scene.

The paper on "Legal Aspects of Boundary Surveys" presented by Chester Mueller, P.E. & L.S., who is also an attorney, cited laws related to the conveyance of land from 1676 to the present.

Harold Valentine, noted New Jersey title attorney, detailed the responsibility of the surveyor to his client. He pointed out that though the surveyor's fee may be small his liability may run to five figures. Many interesting points were emphasized by Mr. Valentine relating to the duties, liability, and responsibility of the surveyor.

The afternoon session was highlighted by the illustrated talk on "Aerial Photography and the Surveyors" presented by C. E. Donado of Aeroflex Corporation. He described aerial surveys as a tool of the surveyor in the preparation of tax maps and topographic maps and in highway right-of-way exploration.

Questionnaires were distributed at the registration desk to determine the interest in and feasibility of Rutger University offering short or refresher courses in surveying—covering property surveys, basic surveying, and photogrammetry and air-photo interpretation. The interest indicated by these questionnaires, according to Professor Paul P. Rice of the Rutgers College of Engineering, has far exceeded expectations. The Land Surveyors Division has been notified that Rutgers will proceed with plans to offer these courses in the fall of 1960.

The Land Surveyors Division (now the Land Surveyors Functional Section) of the N.J.S.P.E. extends an invitation to all members of the American Congress on Surveying and Mapping to attend these conferences.

—THORNTON GARLICK
Corresponding Secretary, LSD, NJSPE

Land Surveyors Ethics

By CURTIS M. BROWN

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CALIFORNIA, like several other States, is preparing a "Manual for Land Surveyors in California." Two years ago I was appointed to do this project. Certain phases of the manual have been completed, ethics being one of them. This manual is for "Property-Line Surveyors" in its narrow sense. Since surveyors in California may do construction staking (roads, buildings, etc.), take topography, and do other things often referred to as engineering surveying, this code can only be interpreted as applicable to a portion of their practice; i.e., the property-line portion. Although much of it is applicable to "engineering surveys" as classified by the ASCE Task Committee (Brother B. Austin Barry's committee), it would probably have to be enlarged and slightly reworded to include all of these strictly technical surveys.

Because there are so many State surveyor organizations now considering this subject, it is deemed advisable to publish this present thinking on cthics. Perhaps the best book written on ethics is *Legal Ethics* by Henry S. Drinker (Columbia University Press, N. Y.). It is recommended for all ethics committees and, for that matter, anyone else. The Property Surveys Division of the American Congress on Surveying and Mapping has an ethics committee headed by able Victor H. Ghent. This code, proposed for California, does not necessarily reflect the ideas or opinions of that committee and is published merely for the purpose of stimulating thinking. It has not been officially adopted in California.

DEFINITION OF ETHICS

That branch of moral science which treats of the duties which a member of a profession owes to the public, to his professional brethren, and to his client, is ethics.

Ethics is not susceptible to an exact definition. The above definition, adapted from *Bouviers Law Dictionary,* rather clearly expresses the intent and purpose of ethics.

"It is a fact with which every one is familiar that an individual may strictly observe the laws of the land and yet be an undesirable citizen and a poor neighbor. The idea that each individual can and should establish for himself rules of conduct for such relations as are not covered by law and without reference to the experience or opinions of others seems equally as absurd as would a similar attempt to establish principles of law. Laws must be established by the majority action of a legislative body, and rules of professional conduct must be based on the concurrent opinions of the members of a profession." ("Standards of Professional Relations and Conduct," by Daniel W. Mead, American Society of Civil Engineers). Rules for professional conduct are ethics.

Lord Moulton in an article in the *Atlantic Monthly* (134 Atlantic Monthly 1, 13, 1924) stated, "The real greatness of a nation, its true civilization, is measured by the extent of Obedience to the Unenforceable." Ethics are often unenforceable. True professional stature arises from obedience to the unenforceable.

Rules of ethics, as adopted by any profession, are not intended to particularize; they are general guides of conduct and behavior.

Advocating observances to ethics is not sufficient; the surveyor's personal example is far more potent. It is not sufficient that the surveyor alone feels that he has honesty and integrity; the public, clients, and fellow practitioners must also believe so. The proof of observance of ethics lies in the opinions of others.

If we, as surveyors, are to maintain a respected position as a profession in the community, we must look beyond the club of the law to ethical standards which prohibit the doing of that which the law does not forbid.

THE SURVEYORS PROFESSIONAL STATUS

Principle: Professional stature cannot be acquired by self proclamation; others must bestow the title upon the surveyor.

The three professions or learned professions as defined by Webster, are theology, law, and medicine. Definitions of a profession, though not exact, include such phrases as "a group of men," following a "learned art," and as a "public service."

We, as surveyors, know that we are in a profession practiced by a group of highly skilled men pursuing a learned art for the benefit of the public. But we, as professional men, are not the sole judge in this matter; others must also think so. Whether surveying is a profession or not is something that the public bestows upon the surveyor. Fortunately, it is not something that is acquired by self proclamation. If it were otherwise, everyone would soon lay claim and become higher in stature whether qualified or not. The professions that the public recognizes and acclaims as professions, i.e., doctors, attorneys, and clergymen, need not use the title professional doctor, professional attorney, or professional clergyman; everyone knows they are professional. The title was bestowed upon them because of their ethics, behavior, and standing in the community. Friends, business acquaintances, and others will evaluate surveyors by their behavior, technical skills, education, and ethics. Only if they behave and act like professional men will the public bestow upon them the privilege of being professionals.

Surveyors enjoy a personal relationship to the client that is similar to that of the legal and medical professions. The client seeks the services of a surveyor for a personal problem, the surveyor serves the client for a fee and at the same time is obligated to protect certain bona fide rights of others. But, unlike the legal, medical, and theological professions, he is not extended privilege communications. As in law and medicine, the surveyor is often given the exclusive right to perform certain duties, and in exchange for this exclusive right he has obligations to the client, the public, and other surveyors. The differences between the surveying profession and a business are:

(1) A relation with the public as an arbitrator of boundary problems and an obligation to protect the boundary rights of others.

(2) A duty of public service though it may incidentally be a means of earning a fee.

(3) The possibility of earning highest eminence without making much money.

(4) A relation to clients in trust.

(5) A relation to other surveyors characterized by fairness.

(6) An unwillingness to use business methods of advertising in self-laudatory language.

(7) Unwillingness to encroach on another surveyor's practice or clients.

SURVEYORS' PRIVILEGES AND OBLIGATIONS

Principle: In exchange for certain exclusive privileges granted by law to the surveyor, he has obligations to the public, the client, and fellow practitioners.

The surveyor and sometimes the engineer, by his license or registration, is given the exclusive privilege to (1) hold himself out as a land surveyor and (2) to monument property lines.

These rights are granted to protect the public from unqualified practitioners. In exchange for these exclusive privileges the professional surveyor has certain obligations to the public, the client and colleagues.

The land surveyor has the authority, by law, to monument property lines, but he does not always have the responsibility of perpetuation. In California, a large portion of our lands were divided by one of the finest systems ever devised, i.e., the sectionalized land system. The Federal Government provided the original monumentation, but no provisions were made for the perpetuation of the system. Perpetuation may be accomplished by delegating such responsibility to public office holders or to private land surveyors. In California each have responsibilities for perpetuation. If in the performance of land surveys, the land surveyor discovers certain facts, such as a material discrepancy from the record (Section 8762 of the Land Surveyors Act), he must file a

public record. Thus, there is a perpetuation of records disclosing the location of found monuments and original survey lines.

Filing of public records of resurveys performed by qualified land surveyors is one of the best methods known for perpetuating surveys. The keeping of secret tie-out records of found originial monuments only leads to confusion. If the land surveyor allows the public to delegate to him the exclusive privilege of performing land surveys, he ought to accept the responsibility of devising some system that assures the perpetuation of former surveys. Failure to do so will certainly result in a loss of public respect, and, in some States, just such a thing has happened.

SURVEYORS' OBLIGATIONS TO THE PUBLIC

The surveyor has the following obligations to the public: (1) to see that the client's boundaries are properly monumented without subtracting from the rights of the adjoiner; (2) not to stir up boundary disputes; (3) not to aid in unauthorized surveying practice; (4) to see that those licensed as surveyors (or as engineers, if engineers are permitted to practice surveying) are properly qualified by character, ability, and training, and (5) that those who prove unworthy of their privileges have those privileges deprived.

Obligations in Monumenting Boundaries.

Every boundary survey for a client establishes the boundary of an adjoiner. One of the reasons for giving surveyors the exclusive privilege of marking boundaries is to prevent the unskilled from monumenting lines that encroach on the bona fide rights of an adjoiner. As an obligation to the public the surveyor should not, in any way, assist a client in acquiring rights to land that are not his to enjoy.

Example 1.—Client "A" asks Surveyor "B" to survey a certain parcel of land by commencing at an existing fence said to be his westerly boundary. The surveyor should refuse. While the surveyor has no liability to the client, since he would be doing as requested, he should decline starting a survey without knowing where the written title lines are. He has an obligation to the public and the adjoiner not to encroach on their rights.

Example 2.—A surveyor is requested to monument a certain property in accordance with a deed known by the surveyor to be defective. If the monuments are set, the client will appear to have land that is not rightfully his. The surveyor should withdraw. He has an obligation to refuse to assist knowingly in morally wrong acts.

Stirring up Litigation

Stirring up litigation, according to common law, is a crime known as maintenance. If the offender in a land boundary case is a surveyor, he is doubly at fault. A surveyor may act as an arbitrator and try to smooth over a difficult boundary situation, but he should not stir up litigation as a solution to the problem, especially where he would collect an expert's fee as part of the litigation.

Because the surveyor is to protect the bona fide rights of the adjoiner, he should not hesitate to point out what the rights of the adjoiner are. If there is long continued possession and title has probably passed by acts of possession and knowledge of such facts would tend to prevent the client from entering in litigation, the surveyor should not hesitate to disclose such facts. However, the surveyor should also suggest that attorneys are the proper parties to render an opinion on such matters.

Aiding Unauthorized Surveying Practice

No surveyor shall permit his name to be used in aid of, or to make possible, the unauthorized practice of surveying by any agency, personal or corporate. (Adapted from American Bar Association, Canon 47).

What constitutes unauthorized practice of surveying must ultimately be resolved by the courts, and ethics committees should be bound by their findings.

The selling of signatures for a fee, i.e., signing a surveyor's certificate and certifying to the correctness of a survey where the work was not performed by himself, his employees, or his direct subordinates, is the most flagrant violation of the intent of a registration law.

A layman may be hired proprely by a surveyor, provided his service does not constitute the practice of surveying, and that his compensation is not a proportion of the fee. Having a layman as a partner in charge of a corporation practicing surveying is a violation of ethics.

Qualifications of Surveyors

Every applicant for registration must furnish a list of professional men as references. It is the duty of those replying to the Board of Registration, in response to questions as to a person's qualifications, to disclose all unfavorable as well as favorable qualifications of the applicant. Friendship, family relationships, sympathy, or any other reason should not influence his thinking.

Likewise, surveyors and surveyor organizations should not hesitate to comment on the quality of the questions being asked on surveyor examinations.

Unworthy Surveyors

Occasionally those who are licensed, by their conduct, prove themselves unworthy of licensing and should have their privileges removed. Surveyors are better able than laymen to appraise the qualifications of other surveyors. If a surveyor is frequently negligent in his duties, that fact will be noticed by several surveyors, who, as a group, can prefer charges.

SURVEYORS' OBLIGATIONS TO CLIENTS

The surveyor, when performing a given service for his client, assumes certain ethical obligations in addition to liabilities. But these obligations to the client may not supersede or interfere with the surveyor's obligations to his colleagues or to the public. He should serve his client faithfully, but he should refuse to do that which is illegal, unethical, or violates a duty to others. The surveyor advises his clients as to what is right and proper, and if the client insists otherwise the surveyor should withdraw.

Correct Survey

Regardless of the fee charged, the surveyor is obligated to perform a correct survey within specified accuracies.

While there are times when the property owner will agree that an inaccurate or approximate property-line survey will suffice for his purpose, the surveyor ought not to accept such a commission. Another surveyor, at a later date, discovering the approximate survey monuments, will take a dim view of the surveyor's ability. Future owners, not knowing the circumstances under which the monuments were established, might be misled. Furthermore, approximately located monuments may be the basis for fraud or deceit on the part of the property owner or the client. Most people assume that surveyors' monuments are located correctly; hence the mere finding of an approximate property corner may be the cause of a costly misconception.

Subcontracting Work

The property-line surveyor who accepts a commission to do a boundary survey may not, except with the consent and knowledge of the client, subcontract or let another organization perform the work.

Whenever a client employs a surveyor he has a right to assume that that surveyor will supervise and direct the work. Subcontracting to another, without the knowledge of the client, is a breach of ethics. A client seeks a particular surveyor because he has confidence in him. If he had wanted another surveyor he would have gone to him in the first place.

It is distinctly proper to refer a client to a colleague whenever a surveyor is too busy or does not have the proper knowledge or facilities to handle the job. But the referral should be without any idea of a kick-back on a fee.

Confidential Communications

Communications between the surveyor and client are confidential. But the surveyor may not be a party to an illegal act or fraud, and communications concerning illegal acts or frauds are not confidential.

At law the surveyor is not given the right to withhold privileged communications. But, unless required by law to disclose the business of a client, communications are confidential. If a client is having a survey made for the purpose of building a large commercial center, such information should

be kept secret until such time as the client wishes to announce the facts.

But this does not mean that the surveyor is to remain silent if a fraud or illegal act is being perpetrated. The surveyor should never join in nor be a party to any illegal act or fraud, nor should he allow his silence to be the cause of fraud or an illegal act.

Personal Interest

The surveyor should not, for his personal gain, take advantage of confidences reposed in him.

Rebates and Double Fees

The surveyor shall not accept any remuneration other than his stated charges for services rendered his clients.

Accepting a fee from the client and a contractor lends the flavor of collusion. But if the client has full knowledge of such facts, no harm can be done. Fees derived merely because of referral to another are entirely unethical.

The surveyor should never be in a position that, because of remunerations or personal interests, it will interfere with his obligations to his client.

Adjoining Surveys

The surveyor often monuments adjoining properties, but where there is a property line dispute, the surveyor should avoid rendering services for the adjoiner unless he has the consent of his client.

In property disputes the arguments are usually over encroachments. A surveyor employed to determine the status of encroachments cannot very well reveal them to a neighbor for another fee. In litigation a surveyor consulted by one party cannot ethically advise the other side, especially if he possesses confidential information. Of course the surveyor must testify in court to all things truthfully and may not withhold any information he is asked about; but this does not mean that he should have preconsultations with the opposing side.

Conflicting Interests

If a surveyor owns adjoining property, or has an interest in it, he should so inform a prospective client.

In the minds of many people is the suspicion that others are always biased towards their own interests. If a surveyor performs a service for such a person without revealing his interest in adjoining property, he may be placed in an embarrassing position if trouble or litigation ensues.

SURVEYORS' OBLIGATIONS TO OTHER SURVEYORS

A profession is partially distinguished by the fairness and courteousness of one practitioner to another and their unwillingness to encroach upon the clients of another. Businesses compete aggressively for competitors' customers; professions do not. A member of a profession values the esteem of his colleagues and the prestige of his calling, especially so the more mature his age. But those who advertise or steal another's customers do not induce cordial reception or pleasant relationship, as it ought to exist, among surveyors. Thus surveyors have obligations to one another.

Professional Reputation

The surveyor or engineer does not attempt to injure falsely or maliciously, directly or indirectly, the professional reputation, prospects, or business of another surveyor or engineer.

Confidence in and respect for a profession are gained by praise of one member for another. Constant sniping between professional people can only degrade the profession.

This ethical rule prohibits the engineer or surveyor from "falsely" or "maliciously" harming the reputation of another. This does not prohibit the right of any surveyor to give proper advice to those seeking relief from negligent surveyors. Surveyors should expose, at the proper time and place, dishonest conduct in their profession and should not hesitate to accept employment that will assist a client who has been wronged. But it is distinctly bad taste and ill manners to accept the word of the client without first checking with the colleague. Many times those making the accusations are not entirely unbiased in their presentation of their side of the story.

Employment

It is unprofessional to attempt to supplant

another Engineer or Land Surveyor by means prohibited by this code of ethics after definite steps have been taken towards his employment. It is unprofessional to compete with another Engineer or Surveyor for employment on the basis of profesional fees, by reducing his usual fees and in this manner attempting to underbid after being informed of the fees named by another.

A surveyor may not properly make a competitive bid for professional service nor may he use decreased fees to entice a client from another. A former employee, who is now starting his own business, may not properly attempt to induce his former employer's clients to turn their accounts over to him, nor should he send announcements of his new office to the clients of his former employer. But he need not refuse employment from them provided he has not either directly or indirectly solicited employment from them.

Discovered Errors

In the event a land surveyor discovers an error or disagrees with the work of another land surveyor, it is the duty of that surveyor to inform the other surveyor of such fact.

Surveys are not for the purpose of stirring up arguments and fights between neighbors. If the adjoining property has been surveyed by another surveyor and the two surveys are not in agreement, the matter should be discussed between the surveyors prior to announcing that an error exists. Sometimes evidence found on the first survey may indicate that a different principle should be used in the later survey. Of course, if a surveyor has made a genuine error, other surveyors should not honor the error, but the first surveyor should be given an opportunity to prove the correctness of his survey if he can.

Review of Another's Work

It is unprofessional to review the work of another Engineer or Land Surveyor for the same client, except with the knowledge or consent of such Engineter or Land Surveyor, or unless the connection of such Engineer or Land Surveyor with the work has been terminated.

Consulting with another's client is considered or appears to be an attempt to supplant the engineer or surveyor. If a request is made to review the work of another, the person making the request should be informed of the ethics involved, and the other surveyor should be promptly notified of the facts. Even in the event that the work of the other surveyor appears to be fraudulent or neglectful, and the other surveyor probably will be charged with misconduct, it is the duty of the surveyor to communicate with the other surveyor and give him the opportunity of reply.

Advertising

It is unprofessional to advertise in self-laudatory language, or in any other manner derogatory to the dignity of the profession.

What is advertising in self-laudatory language is not exactly definable and until surveyors and engineers are more specific, this rule of ethics will have little force. Other professions are more detailed and specific. The sign on an office building (attorneys) is tested by whether the sign is calculated to enable a person looking for a particular lawyer to find him or whether the sign is calculated to attract the attention of persons who might be looking for a lawyer. Canon 27 of the American Bar Association's Professional Ethics states: "It is unprofessional to solicit professional employment by circulars, advertisements, through touters, or by personal communications or interviews not warranted by personal relations. Indirect advertisements for professional employment such as furnishing of inspiring newspaper comments, or procuring his photograph to be published in connection with causes in which the lawyer has been or is engaged or concerning the manner of their conduct, the magnitude of the interest involved, the importance of the lawyer's position, and all other like self-laudation, offend the traditions, and lower the tone of our profession and are reprehensible; but the customary use of simple professional cards is not improper."

Discredit to the Profession

It is unprofessional to act in any manner or engage in any practice which will tend to bring discredit on the honor or dignity of

the Engineering and/or Land Surveying Professions.

A surveyor should not aid a client in perpetrating a fraud nor assist him in an illegal act. He should not, in his personal appearance or manner of conduct before the public or others, bring discredit to himself as a professional man.

Fees

No division of fees for surveying service is proper, except with another surveyor or engineer who by his license is permitted to do land surveying work, based upon a division of service or responsibility. In determining the amount of the fee, it is proper to consider; (1) the time and labor required, the novelty and difficulty of the questions involved and the skill requisite properly to conduct the survey; (2) the customary charges of the surveyor associations for similar service; (3) the amount of liability involved and the benefits resulting to the client from the services; (4) the contingency or the certainty of the compensation; and (5) the character of the employment, whether casual or for an established and constant client. No one of these considerations in itself is controlling. They are mere guides in ascertaining the real value of the service.

In determining the customary charges of the Surveyors Associations for similar services, it is proper for a surveyor to consider a schedule of minimum fees adopted by a Surveyors Association, but no surveyor should permit himself to be controlled thereby as his sole guide in determining the amount of his fee.

Minimum fee schedules are a guide and can never be a binding agreement between surveyors. Antitrust laws prohibit such price fixing.

Intermediaries

The professional services of a Surveyor should not be controlled or exploited by any lay agency, personal or corporate, which intervenes between client and surveyor.

₹ ₹ ₹

U.S.G.S. Studying Surface of the Moon

A U. S. Department of the Interior release bearing the data of February 28, 1960, states that the U. S. Geological Survey is engaged in a terrain* study of the surface of the moon, which may prove highly valuable in the selection of a landing site for initial scientific investigation of the moon.

The terrain study, when completed this year, may also have an effect on the design of surface vehicles for use on the moon, for geologic moon investigations, and for further space exploration.

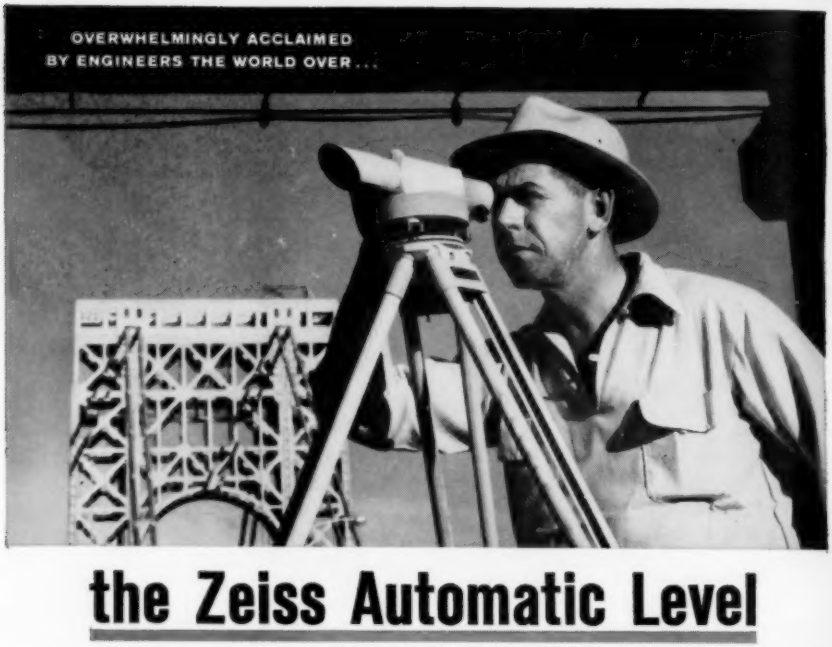
In the first phase of the Survey's study a team headed by photogeologist Robert J. Hackman employed modern stereoscopic methods to plot the relationships of surface features of the moon. With this phase completed, Survey personnel will interpret the moon's surface constituents, textures, and bearing power. Advance information on the probable characteristics of the moon's surface may likewise assist in designing proper tools for excavation, should taking refuge underground be necessary for man's survival on the moon. Moon surface temperatures soar above 200 degrees during the long lunar daylight.

Application of the techniques of geologic study to the moon's surface, augmenting what has already been learned by astronomers, will broaden man's knowledge of the moon and will constitute an important contribution to the Nation's space program.

In the first phase of the moon study, thousands of lunar photographs were examined both in the United States and in Europe to select photographs which could be used for stereoscopic work. Stereoscopic photographs of the moon are possible because, while the moon presents approximately the same face to the earth, the face actually rotates back and forth slightly so that over a period of time about 60 percent of the entire lunar surface is visible.

The entire study will be at a scale of one inch equals 80 miles and will be registered over a base map of the moon now in preparation by the Army Map Service.

* Methinks maybe this should be "monrain." EDITOR.



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For 7 years now, in U.S. and Canada, contractors of every size, industrial, governmental and military field men have *tried* and *proved* the Zeiss automatic level (K&E NP5028). They all concur: it's faster to use, far simpler . . . and far more accurate.

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A book could be written about the success stories of this remarkable instrument. As a matter of fact, one has been . . . a fascinating collection of case histories from around the world. The book is full of worthwhile tips and techniques. It's free, and a copy can be yours in a week or so, if you write for it, today.

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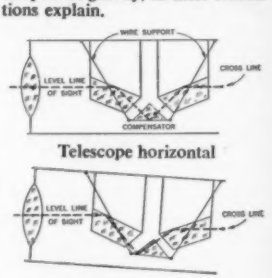
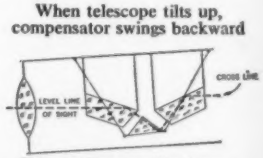
of the Zeiss level casebook, write to Keuffel & Esser Co., Hoboken, N. J., Dept. SM-6. The Zeiss Automatic Level (K&E NP5028) is sold exclusively through K&E dealers.

How does the Ni 2 work?

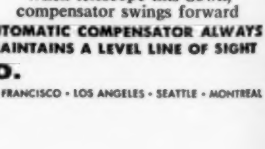
A *built-in compensator* . . . a lower prism suspended by specially treated fine wires . . . *automatically maintains a level line of sight* through the pull of gravity, as these illustrations explain.



Telescope horizontal



When telescope tilts up, compensator swings backward



When telescope tilts down, compensator swings forward

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1960 Antarctic Research Program

H. Arnold Karo

DIRECTOR, COAST AND GEODETIC SURVEY

UNITED STATES scientific research in the Antarctic is being supported by National Science Foundation grants which provide both for field work on the frozen continent and for associated research in the United States. The new research program will include the disciples of geology, cartography, and biology, which were not included in the International Geophysical Year (IGY) that ended December 1958. Data in these fields of research were accumulated during the IGY only incidentally to the geophysical investigations of the US-IGY program. Many very basic questions about Antarctica remain unanswered, as for example the locations of mountain ranges and the types of marine life around the continent. Work during the forthcoming year will attempt to fill in many of these gaps in our knowledge. Thirty-five scientists will remain in Antarctica through the 1960 winter, with twice this number scheduled for assignment during the next Antarctic summer.

Grants for a total of 29 projects have been announced with others expected in due time. In addition, field work will be carried on during the austral summer under earlier NSF grants. In many cases the investigations will be international in scope, with scientists and technicians from many parts of the world participating.

Projects of the U. S. Antarctic Research Program (USARP) are assigned by the National Science Foundation in consultation with the Committee on Polar Research of the National Academy of Sciences-National Research Council. The committee was formed to advise on the Antarctic program when the Foundation was directed to coordinate and administer the U. S. scientific effort in the Antarctic following the IGY. Government agencies with interests in the Antarctic are represented on the Interdepartmental Committee on Antarctic Research, a second advisory group assisting the Foundation.

USARP provides for research to be conducted at seven Antarctic installations, as well as in laboratories and research centers in the U. S. The Byrd and Pole Stations and the Naval Air Facility, McMurdo, are wholly U. S. stations. At Hallett Station the program is a cooperative New Zealand-U. S. effort, as it was throughout the IGY. Since the end of the IGY, the Ellsworth and Wilkes Station programs have been run jointly with Argentina and Australia, respectively. At New Zealand's Scott Base on McMurdo Sound a small group of U. S. scientists work on common projects with New Zealand investigators.

The seven-station meteorology network established by the U. S. at the beginning of the International Geophysical Year will be continued through a National Science Foundation grant to the U. S. Weather Bureau. Meteorologists will winter at the four stations wholly supported by the U. S. and will join parties working at Hallett, Wilkes, and Ellsworth Stations which are cooperative programs with New Zealand, Australia, and Argentina, respectively.

NAVAL LOGISTIC SUPPORT

Scientific research in the Antarctic is made possible through the logistic support of the Navy Department, which has had long experience in Polar operations and has mounted several expeditions to Antarctica. The U. S. Naval Support Force for the operation will be commanded by Rear Admiral David M. Tyree, USN, who relieved Rear Admiral George J. Dufek, USN, in April 1959.

EDITOR'S NOTE.—In reading this article, it should be kept in mind that the manuscript was received late in November 1959 and that for lack of both space and time this paper could not be included in the March 1960 issue of SURVEYING AND MAPPING. Thus it turns out that much of the work described will have been accomplished by the time this reaches the reader.

The U. S. Naval Support Force, Antarctica, provides the operating personnel for the Byrd, Hallett, and Pole Stations and for NAF McMurdo. It also furnishes transportation into these stations from New Zealand. During the summer—from October to March—the U. S. Naval Support Force provides the logistic support to transport scientific personnel into McMurdo Sound and from there to outlying stations and areas of scientific interest.

The summer programs are conducted during the six-month period of highest temperatures, 24-hour sunlight, and accessibility to remote areas by air and water. With the approach of winter in March, plane and ship activity ceases and the scientists are isolated until the following austral spring. Intensive station programs are continued throughout the entire year, however.

Part of the NSF program will include a United States scientific expedition to the Bellingshausen Sea. Penetration will be attempted into these uncertain waters by two U. S. Navy ice breakers, and if successful the scientific party will gather valuable data in a region never before explored. Scientists aboard the ships will include investigators in biology, geology, cartography, oceanography, and glaciology.

GEODESY AND CARTOGRAPHY

The mapping of Antarctica is a primary scientific requirement because maps support most other scientific activities. Many previously observed features have not been accurately positioned. Large-scale topographic mapping will be carried out by the U. S. Geological Survey of selected critical land areas of much of Antarctica, using topographic information and mapping photography from past and current Antarctic activities. Large-scale maps will continue to be compiled of coastal and mountainous areas, including areas where aerial photography and control are already available.

This program will include geodetic control in the mountain ranges of outer Marie Byrd Land (Executive Committee, Hal Flood, and Edsel Ford Mountains), and Victoria Land and the Bellingshausen-Amundsen sea coasts. Previous field work by IGY traverse parties has resulted in control stations in the Horlick, Queen Maude, and Sentinel Ranges.

During 1959–60 the New Zealand Geological Survey will establish control in the mountains along the western edge of the Ross Ice Shelf between McMurdo Sound and the Beardmore Glacier. These control data will be used by the Geological Survey for the preparation of maps in conjunction with aerial photography obtained by the United States. This photography will also be made available to New Zealand.

The control data of previous operations and that obtained by the Survey's field engineers during the present austral summer will be used in conjunction with the aerial photography flown in 1959–60 for making maps. Photography will be accomplished by a Super Constellation (R7V) and Neptune (P2V) of the Navy's Air Development Squadron Six. The photographic staff of the Naval Support Force will develop the aerial film at NAF, McMurdo. On its return to the United States the film will be delivered to the Geological Survey's Special Maps Branch. New maps will be prepared during 1960.

During the 1960 season the Coast and Geodetic Survey will identify a permanent geographic position near the South Pole with an appropriate marker. A bronze disc will be emplaced to indicate the exact location of the USARP South Pole Station at latitude 89°59′43.6″ plus or minus 0.7″ S. and longitude 24.8° plus or minus 2.4° W. At this point the IGY Scientific Leader, Major Palle Mogensen, made 52 independent sets of astronomical observations during many cold and dark nights in Antarctica. Many nights when the readings were being made the thermometer registered temperatures as low as 100° below zero Fahrenheit. Data resulting from these observations were brought back to the United States by Major Mogensen and turned over to the Coast and Geodetic Survey for computation of the exact position of his observing station. Scientists of the Bureau have determined that the South Geographic Pole lies approximately 1,650 feet south of Major Mogensen's station.

In an entire year probably no more than 25 of the most adventurous men in the world will ever see the emplaced marker which would reveal to them the close proximity of this position to the South Pole. About

half of the scientists and Polar explorers who will see this unique geodetic station will be members of the United States Navy and the other half will be United States scientists concerned with such problems as geomagnetism, seismology, ionospheric physics, meteorology, aurora and airglow, glaciology, and others in their efforts to unlock some of the age-old secrets of Antarctica. Such work is now being carried out at the South Pole by United States scientists. Included in present activities are additional astronomical observations by the Coast and Geodetic Survey in connection with studies being made in the fields of geomagnetism and seismology. Astronomic data will be used to refine the accuracy of locating the exact point of the south polar axis of the globe.

GEOMAGNETISM IN ANTARCTICA

The National Science Foundation, through USARP, has made it possible to continue many research programs in geomagnetism on the vast Antarctic continent. The Coast and Geodetic Survey, with its significant capabilities in this field, is cooperating to the fullest extent by maintaining and operating geomagnetic observatories at Pole and Byrd Stations and by furnishing technical assistance and resupply items in support of geomagnetic programs to be continued at New Zealand's Hallett Station and at Australia's Wilkes Station.

The Survey has the capability of conducting a new and extended geomagnetic field program in Antarctica. Such a program would involve assigning an experienced magnetic observer to each of the summer traverse parties that will travel over many hundreds of miles during the daylight season of Antarctica. Observations could be made to determine not only the earth's total magnetic field, but also components of the field. The most modern instrumental equipment would be used for the work.

The primary objective of the geomagnetic program in Antarctica is to provide data regarding temporal changes in the magnetic field of the earth. The results of these measurements will be extremely valuable in further investigations on the simultaneity of the incidence of geomagnetic disturbances and related geophysical phenomena throughout the world. Additionally, these data will be indispensable for the interpretation of other scientific observations made at the identical sites by other disciplines, particularly aurora and ionospheric physics. Results of field observations, coupled with permanent observatory programs, will furnish long-needed magnetic information for use in the preparation of world magnetic charts.

AGS MAPPING IN ANTARCTICA

At the beginning of the International Geophysical Year the American Geographical Society undertook the production of a 1:3,000,000-scale map of the Antarctic Continent. Near the close of the IGY the map received a major revision based on the findings of traverses and other IGY studies. Further revision will be desirable as new geographic discoveries are made to insure the best possible map for use by scientists in Antarctica, planners working in many countries, and to the layman. NSF funds will be provided to keep the map up to date by adding discoveries as they are made, correcting features which are more accurately

positioned, and inserting accepted names for new features.

The Foundation in 1958 sponsored a study leading to the preparation of an Antarctic Atlas. The study was undertaken by the American Geographical Society under an NSF grant, and was recommended by the NAS Committee on Polar Research. The Society sought advice from scientists in all disciplines of study. The NSF is providing funds for analysis of the requirements and detailed planning of the Atlas.

The Atlas will contain a series of base maps portraying many characteristics of the continent as they vary by seasons and by location. Climatic conditions, the appearance of sea ice, and the configuration of the subsurface topography are examples of the information which may be included in such an Atlas.

1959–60 TRAVERSE PLANS

Two geologists will accompany oversnow traverses during the summer season in Antarctica. On the first traverse a party of seven or eight scientists will climb the Skelton Glacier from McMurdo Sound in October, for a three-month survey of Victoria Land, a desolate, ice-capped expanse of 7,000 to 9,000 feet elevation. The traverse party will proceed into the interior of the plateau to about 74° S. latitude, 140° E. longitude, and then to the Hallett Station area.

Seismic soundings, gravity, magnetic, and glaciological studies will be made along the traverse route in addition to geological investigations in the Skelton and Hallett areas. Topographic control points will be established where ice-free areas are encountered.

The traverse will be supported by a Navy air-supplied fuel cache at the top of Skelton Glacier and a parachute supply drop from a C-124 Globemaster. Vehicles will be left at the top of Tucker Glacier near Hallett Station for later use, and the party will return to McMurdo by air.

A second party will leave Byrd Station in October 1960 for a 1,200-mile traverse of Marie Byrd Land to the coast near the Amundsen Sea. In the Executive Committee and Hal Flood Ranges geological and geodetic studies will be conducted. The party will then travel south to "Army-Navy Drive," tractor train supply trail to Byrd Station, and follow it back to the station. The geophysical and geological investigations of this seven-man party are expected to contribute greatly to the slim store of knowledge about the area. This group will also provide data for mapmaking.

The oversnow traverses are operated by the Arctic Institute of North America under NSF grants. The Geological Survey provides for the topographic surveys and geological work of the traverse parties. In preparation for geophysical traverse programs during the 1960–61 field program, funds also have been made available to the University of Wisconsin. One traverse is scheduled to depart Byrd Station in November 1960 and proceed to the Bellingshausen Sea coast. A second traverse will penetrate the high polar plateau in the area between McMurdo, the Russian station Vostok, and the South Pole Station.

An airborne traverse for seismic, gravity, and magnetic investigations will be put into the field by the University of Wisconsin. Three scientists will be landed at 8 to 12 evenly spaced points along the 88th west meridian between Horlick and the Sentinel Mountains. Their investigations are expected to define the subsurface features including the possible trough between the Weddell Sea and the Ross Sea.

* * *

IT IS NOT TOO EARLY TO BEGIN PLANNING TO ATTEND THE 1961 MEETINGS

Autocentering

By H. MATTHIAS

THE INTERCHANGE of instrument and target, subtense bar, or other equipment on a tripod in such a manner that centering is maintained automatically and with high precision is a feature of certain surveying instruments and tripods which will be called "autocentering." In surveys which require the occupation of each of a series of stations by an instrument and various accessories in turn, autocentering will result in more consistent and higher precision as well as in a considerable saving in time.

While several manufacturers produce equipment which permits autocentering, Kern equipment is designed particularly for this method and will be described in this paper, which also contains descriptions of practical applications of autocentering.

The centering tripod is, literally and figuratively, the foundation upon which the method is based. This tripod does three things simply and simultaneously:

(1) It centers the instrument or accessory over the station point within 0.04 inch;

(2) It roughly levels the tripod head within 2′ of arc; and

(3) It gives the instrument height (H.I.) above the station point.

The centering rod is telescoping and adjustable within a range of instrument height of from 3.8 to 6.0 feet. It carries a bullseye level which is centered by moving the tripod head with respect to the tripod headplate.

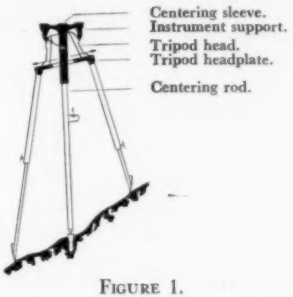

FIGURE 1.

When the bubble is centered, the tripod head is centered over the station point and the top of the tripod head, upon which the instrument or accessory is set, is level. (Figure 1.)

Autocentering is accomplished by means of the centering sleeve of the tripod head and the matching centering plug in the base of the instrument or accessory. Sleeve and plug are machined to close tolerances

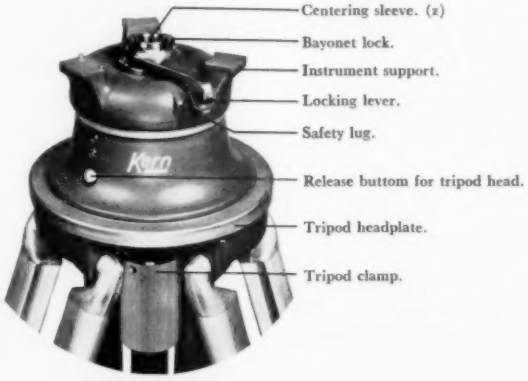

FIGURE 2.

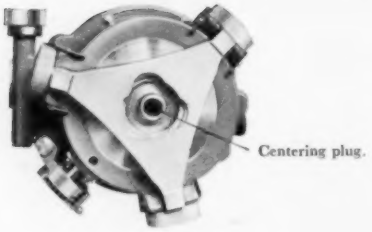

FIGURE 3.

FIGURE 4.

which provide a play of 0.002 inch. Thus, the centering of each instrument or accessory which is set on a given tripod is duplicated within the limit of this play. (Figures 2 & 3.)

The accuracy of the rough leveling of the tripod head, automatically achieved by the centering tripod, is such that a relative change in the instrument height of less than 0.01 inch is sufficient to accomplish the "fine" leveling of the instrument or accessory. During the fine leveling, the centering plug, the axis of which coincides with the vertical axis of the instrument, pivots about point "Z" (Figure 2) within the centering sleeve. The twist resulting between the centering plug and the centering sleeve is so small that the play provided between the two is ample to accommodate it.

FIGURE 5.

The instrument is fastened to the tripod head by means of a bayonet lock actuated by a lever on the tripod head. Three lugs on the bayonet lock (Figure 2) enter openings in the base plate of the instrument or accessory and are then rotated to lock the instrument to the tripod head.

Another tripod manufactured by Kern is called the tilting plate tripod. (Figure 6.) It consists of a plate mounted in gimbals and superimposed on the main tripod head. The upper plate carries two cross-levels countersunk in its surface. When the plate is leveled, the optical plummet can be used to center the instrument without the exhaustive shifting and leveling required when a tripod head is not level. The tilting plate tripod, as such, cannot be used for autocentering. However, by attaching a centering plate to this tripod, it may be used in the same manner as a centering tripod. The centering plate has a centering sleeve and bayonet lock similar to those on the centering tripod, so the same interchangeability is possible.

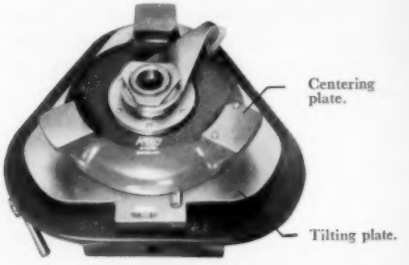

FIGURE 6.

The following instruments and accessories are designed for autocentering:

FIGURE 7.

Theodolites

All types in the three sizes, DKM1, DKM2, and DKM3, and also the reduction tacheometers DKRT and DKRV. The centering tripods are made in three corresponding sizes and are so designed that each instrument fits both the tripod intended for it or the next larger size. The oversized tripod is desirable when greater tripod weight or stability is required. The instrument height "I" (Figure 7)—from base to horizontal axis—is standardized at 100 mm. (3.94 in.), 160 mm. (6.30 in.), and 170 mm (6.70 in.) for the DKM1, DKM2, and DKM3, respectively.

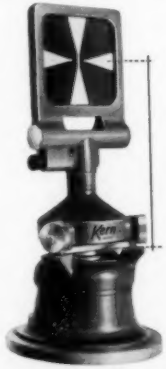

FIGURE 8.

Targets

Kern targets have a leveling base identical with that of the theodolites. The instrument height "S" (Figure 8)—from base to center of target—is 160 mm. (6.30 in.).

Stadia and Subtense Bars

Stadia boards for the DM distance wedge attachments and for the DKRT reduction tacheometer can be used on the centering tripods with an appropriate footpiece and fastening bracket, the latter equipped with a peep sight and a special mark for azimuth measurement. The instrument height "S" (Figure 9)—from base to center of board—is 170 mm. (6.70 in.).

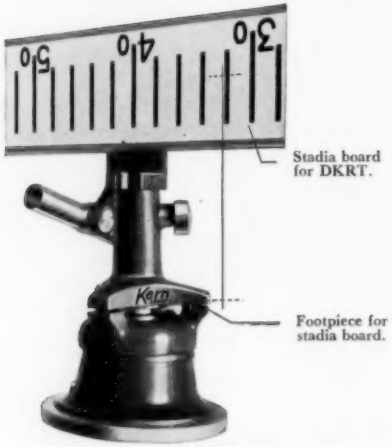

FIGURE 9.

The subtense bar (Figure 10) is equipped with the same footpiece and a specially designed bracket. This bracket is equipped with a peep sight to properly orient the bar. A circular mark serves for the measurement of both direction and elevation. The instrument height "S"—base to circular mark—is 160 mm. (6.30 in.), the same as that of the DKM2, since this is the theodolite most frequently used with the subtense bar.

Optical Plummets

The optical plummet (Figure 11) is used in mine and tunnel work. It can be used to transfer ground points to tunnel spads. It is particularly valuable in establishing centering tripods under roof spads so that isocentering may be used in tunnel work.

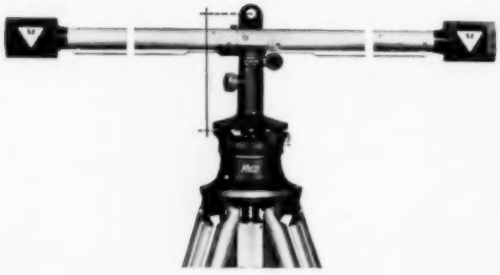

FIGURE 10.

FIGURE 11.

Trivets

Kern trivets (Figures 12 to 17, inc.) for setting up on piers and towers, are made in two sizes and are similar in design to the centering tripods. Coarse leveling and centering of the centering sleeve over the station point are accomplished simultaneously by centering a bullseye level. A centering pin on a spring-loaded plunger (Figure 13) or a height gage with a spherical end (Figure 15) serve to establish the centering. The height gage with the spherical end is used primarily for deformation measurements on power dams, where it is necessary to set up exactly over a point and at the same elevation many times over a long period of time.

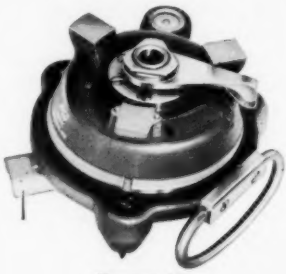

FIGURE 12.

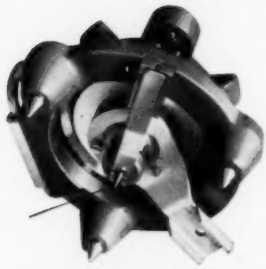

FIGURE 13.

FIGURE 14.

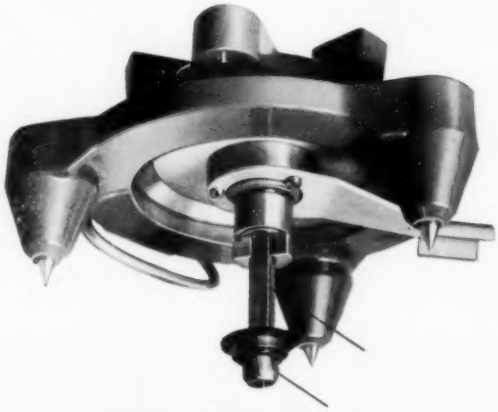

FIGURE 15.

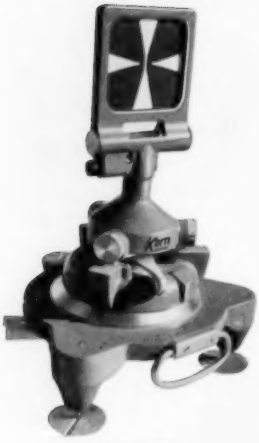

FIGURE 16.

Special Centering Rod

The special centering rod (Figure 18) permits centering over a station point with an accuracy of 0.004 inch. It combines the great accuracy of the optical plummet with the speed and ease of operation of the centering rod. Inside the point of the special centering rod is the illuminated image of a center mark. This image is viewed through the hollow rod by means of the optical plummet.

FIGURE 17.

FIGURE 18.

The accuracy inherent in autocentering is enhanced by close manufacturing tolerances. The play between the centering sleeve, centering plate, or trivet and the centering plug of instrument or accessory is 0.05 mm. (0.002 in.). The maximum eccentricity between centering plug and vertical axis of targets is also 0.05 mm. (0.002 in.). The same is true of the bases for stadia boards and subtense bars. The maximum eccentricity between vertical axis and center of target is 0.5 mm. (0.02 in.).

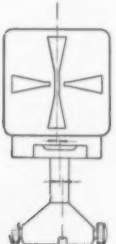

FIGURE 19.

The tolerance in length of the two-meter subtense bar is 0.03 mm. (0.001 in.), which corresponds to a precision of one part in 66,667. The maximum eccentricity between the vertical axis of the bar and the point midway between the end targets is 1 mm. (0.04 in.). The tolerance in height of

instrument or accessory above its base is 0.5 mm. (0.02 in.).

FIGURE 20.

These tolerances are sufficient for the most precise work. However, when unusually short sights are involved, it may become necessary to determine the influence of the systematic errors inherent in the equipment and either take them into account in an error analysis or eliminate them by an appropriate arrangement of measurements.

The stability of support provided by the centering tripod is such as to justify the tolerances listed above. With the tripod head locked and the instrument or accessory locked to the tripod head, tripod and instrument or accessory form one solid unit. The bayonet lock used to fasten the instrument or accessory to the tripod head is quick and easy to use. There is no danger of accidentally changing the position of the instrument support when placing or removing the instrument or accessory. The "locked" position of the lever for the bayonet lock is assured by the safety lug. (*See* Figure 2.)

Height of instrument and accessory are identical in most cases. Where they are not identical, the difference is a constant due to the standardization referred to earlier. The relatively accurate "coarse" leveling achieved by the centering tripod is such that the instrument height is, for all practical purposes, unchanged by the fine leveling. The vertical range of the leveling knobs (which replace the conventional foot screws) is only 0.3 mm. (0.01 in.). The effect of the fine leveling on instrument height can be eliminated entirely if one leveling knob is left in the centered position and the leveling is accomplished by using the other two knobs only.

PRACTICAL APPLICATIONS OF AUTOCENTERING

Reduction to Center

The occupation of an eccentric station

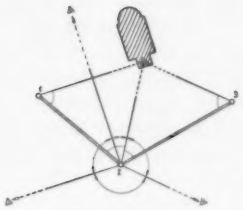

FIGURE 21.

is shown in Figure 21. One tripod is set up on point 2 for the duration of the measurements, while a second tripod occupies points 1 and 3 in turn. The lengths of lines 1-2 and 2-3 are determined. Equipment required: 1 theodolite, 1 distance wedge outfit (or subtense bar), 2 tripods, and 1 target.

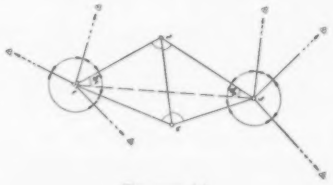

FIGURE 22.

Obstacle on Line

The direction of line 1-3 in Figure 22 is to be determined. The extremities of the line are not intervisible. Points 2 and 4 are chosen so that they are intervisible and both see points 1 and 3. Angles are measured as shown to determine angles δ_1 and δ_2. Tripods are set on points 1, 2, 3, and 4 for the duration of the work. No distances need be measured if the quadrilateral is approximately rectilinear. Equipment required: 1 theodolite, 4 tripods, and 4 targets.

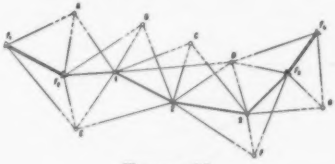

FIGURE 23.

Combined Traverse and Triangulation

This method permits the determination

of the coordinates of the stations of the traverse, points 1, 2, and 3, and of the auxiliary points A, B, C, D, E, F, and G. Of course, the horizontal locations of points F_1, F_2, F_3, and F_4 must be known. Equipment required; 1 theodolite, 3 tripods, 2 targets, and range poles to mark points A to G, inc.

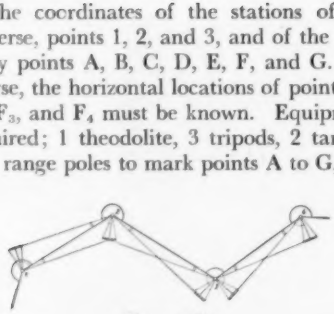

FIGURE 24.

Traversing

Possible combinations of equipment.

A. Instrument:
One-minute or one-second theodolite.
Distance measure:
Distance wedge outfit type DM or DM-M, comprising
1 distance wedge attachment,
2 stadia boards,
2 bases with brackets for boards.
Tripods:
3 centering tripods or 3 tilting-plate tripods with a centering plate for each.

B. Instrument and distance measure:
DKRT reduction tacheometer,
2 stadia boards,
2 bases with brackets for boards.
Tripods:
As in A.

C. Instrument and distance measure:
One 1″ theodolite,
1 subtense bar,
1 base with bracket for bar.
Tripods:
As in A.
Accessories:
2 targets.

Precise Traverse

In rough terrain the horizontal and vertical locations of a number of closely spaced points, say 150 feet apart, is to be determined precisely. The only logical method to achieve the desired accuracy is a precise traverse with autocentering. Elevations are determined by measuring vertical angles. Since instrument and accessory heights are known accurately (see earlier remarks), the elevations so obtained are more acurate and more easily determined than those obtained by leveling. Equipment required: Combination C, above.

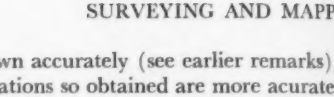

FIGURE 25.

Traverse with Long Sides

To locate points which are further apart, say 1,000 to 3,000 feet, traversing is also effective. The lengths of the traverse sides are obtained by auxiliary triangulation. Figure 24 indicates a method suitable for traversing with sides about 1,000 feet long and Figure 25 a method for traverses with sides about 3,000 feet long.

There are innumerable combinations of methods that can be used for traversing. In the examples shown, the sides are determined twice, independently. The determining factors in the selection of the length of an auxiliary base are the length of the corresponding traverse side, the base angles of the auxiliary triangle, and the method used to determine the length of the auxiliary base. A study of the theory of errors applying to these examples shows the advantage of using a subtense bar for the determination of auxiliary base lengths. Equipment required: Combination C, above, with 5 to 6 tripods and 4 targets.

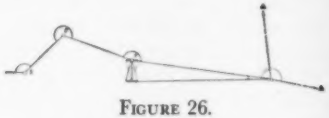

FIGURE 26.

Connection with a Normal Traverse Containing One Long Side

The auxiliary base is measured twice, once in each direction, using the subtense bar. Equipment required: Combination C, above.

Tunnel and Mine Surveys

Autocentering is particularly advantageous in tunnel and mine surveys which con-

sist of long traverses often involving unusually short sights. For traverses with sides of normal length and for very steep traverses with short sides, equipment combinations A, B, or C are recommended. For traverses with sides over 1,500 feet long distance measurement can be made with a tape or optically, subdividing the side into convenient lengths.

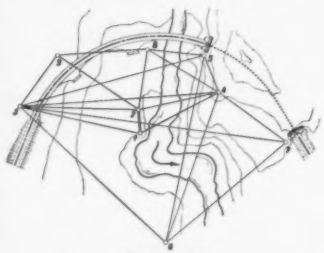

FIGURE 27.

Short-range Triangulation for Construction

The term "short-range triangulation" is used to designate surveys which provide the control for extensive construction projects. Figure 27 shows an example, a railroad viaduct with a connecting tunnel. Here autocentering is an ideal method even though a single traverse is not sufficient to provide the control. If no triangulation points are available to provide a known distance, it is necessary to establish a base line and to introduce this "scale" into the net by means of autocentering. The subtense bar is most practical for this work because of its precision when long lines are subdivided and because it is not adversely affected by the roughest terrain.

These examples show the importance of autocentering. The method always produces higher precision and greater working speed. One of these two factors will be the decisive one in the selection of a method of work. For the solution of special problems, autocentering makes possible a precision which heretofore was unknown in surveying.

FIGURE 28.—Aerial photograph of area shown schematically in Figure 27. (Copyright Swissair Photo A. G., Zurich, Switzerland).

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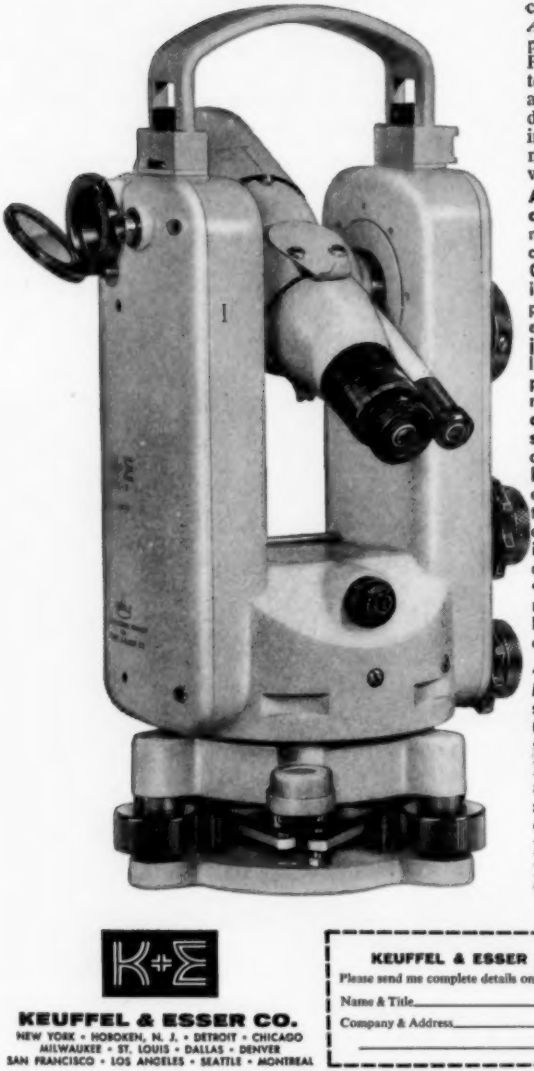

Ideal for triangulation and traverse up to and including second order. Excellent for making astronomical observations and for precise surveys of all types. Reading direct to one second, with estimation to 0.1 second.

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1954

The Coordination of Ground and Aerial Surveying in Highway Engineering

By RICHARD E. MORRIS

PROJECT ENGINEER, MEISSNER ENGINEERS INC., CHICAGO, ILLINOIS

DURING the past ten years considerable publicity has been given to the advantages of aerial surveying in highway engineering. Considerably less has been said about the ground surveying that is still required in order to produce a complete set of contract plans, estimates, and right-of-way plats. The purpose of this paper is to demonstrate the coordination of ground and aerial work which our firm has found to be satisfactory. We have followed the procedure outlined in the following paragraphs on a number of Interstate Highway projects and find that it produces good results for the client and that it is economical to carry out.

In the usual case where a Consultant is called upon by a State Highway Department to design a section of highway, the route is known to the extent that it can be defined by a band 1,000 feet wide. The locations of interchanges and major intersecting road relocations are also known. At the earliest date possible a contract is let to a reputable aerial mapping company for the photography and the preparation of the contour maps. In rural work the scale requirement may be 1″ = 50′ or 1″ = 100′ depending upon the job requirements or the client's specifications. Two-foot contours are usually specified, with one-foot contours at major structure sites. In addition to the usual topographic features, the finished maps are required to show coordinate grid lines at appropriate intervals.

Photogrammetric maps are dependent upon accurate ground control and, consequently, a ground survey crew must complete its work before the maps can be produced. All aerial firms will do their own ground control if requested to do so, or we do it ourselves. We have had excellent results both ways and the choice is strictly a consideration of comparative costs and our work load at the time. When we do the work ourselves, we ask the aerial firm to spell out exactly what they need and then work accordingly. We use a Wild T-2 theodolite, Tellurometer, and subtense bar, and tie the survey to the State Plane Coordinate System and U.S.C. & G.S. sea level datum, except in urban areas where other datums are required. We always work to at least third order accuracy.

The net result of the ground-control survey, aside from furnishing the essential information for the completion of the topographic maps, is that it leaves a liberal sprinkling of permanent or semipermanent markers and monuments scattered over the project area. They are, of necessity, intervisible, accessible, and usable in a dozen ways from the project's conception through construction. Once the ground-control survey is complete the data are transmitted to the aerial firm and they can proceed with the preparation of the maps in their stereoplotters. When we begin receiving maps from the map contractors, preliminary design is begun. Paper locations are made, ground profiles are picked off from the contours, and tentative grades and alignments established. Generally, it takes a comparatively short time to set a horizontal location that is final within a few feet.

With regard to field work at this stage, the project centerline is not yet ready to be staked in the field. Nevertheless, there is much field work to be done, and we are usually impatient to proceed with it. Regardless of how good the photogrammetric maps are, we have found it necessary to make many ties by field measurements, including the locations of some buildings and structures, locations and grades of all intersecting roads, and, most of all, the locations

of property and section corners. It is at this point that we make extensive use of the traverse points set in the course of the ground-control survey. Using the paper location of the project centerline as a guide as to what will be eventually needed when the job is ready for final design, the centerlines of the intersecting roads can be tied in to the grid system, their grid bearings determined, and the existing grades determined. The exact locations of buildings and other structures can be connected to the control survey and their grid positions computed.

In the case of property corners, we usually work from published plat books until the paper line is pretty well set. Later, of course, we order the necessary ownership information from an abstractor. The locating of property and section corners is serious business and we proceed cautiously. We always consult local surveyors and county surveyors and sometimes retain a local surveyor to assist us in this precarious phase of the work. Once the corners are located, we then tie them in to the grid system and determine their coordinates. The obvious advantage of proceedings in this manner is that we are able to pin-point the position of nearly all field features that have any bearing on the work before the centerline is staked or even finally located on paper. This field work is usable regardless of the final pin-pointed location of the line because none of the work so far has been tied to the centerline stationing.

Once the centerline is pin-pointed on paper, the coordinates of the P.I.'s of the tangents can be scaled from the maps and we then assume that we can exactly reproduce these P.I. coordinates on the ground. Proceeding on this assumption, we then compute the complete horizontal alignment, delta angles, curve data, and stationing. Then it is possible to compute the station and intersecting angles of property lines and cross roads which have previously been tied in to the grid system by the field surveys. The calculated line is then carefully plotted on the topographic maps, and ground cross sections are read from the contour lines, thus allowing final design to be well under way before the line is staked. It is evident from all of this that we postpone the staking of the line until the latest date possible because of the ever present possibility of a line shift.

Obviously, once we have committed ourselves to a precalculated line, we are faced with the problem of getting this same line on the ground. In order to do this we usually run a secondary traverse along the general route of the centerline in such a way that traverse points will fall within a tape length of P.I.'s and such P.O.T.'s as will be required to lay out the tangents. This secondary traverse is run and balanced between the ground-control points already in place. Ties are then computed from these secondary traverse points and the aforementioned tangent points. The required location of these secondary traverse points is readily determined by examination of the topographic maps. Once the P.I.'s and P.O.T.'s have been set in from the traverse, it is a relatively simple matter to stake tangent lines. The delta angles are checked immediately, and we have had no trouble getting these to agree with the computed values within 20 seconds, which is generally acceptable in highway work. It is our policy to hold the ground position of the P.I. as set out from the traverse, moving the intermediate points in a direction perpendicular to the tangent line, if necessary, to bring them on line between the P.I.'s and then holding these points as final insofar as chaining, stationing, and staking are concerned. Mistakes are made of course, but they are usually obvious. The entire procedure has enough built-in checks to uncover errors in field work or computations. Our design contracts always require us to leave a well referenced line in the field so that the major line-control points can be recovered years later, if necessary. This is done in the conventional manner; iron pins that will respond to a dip needle are placed in fence rows and below plow depth in open fields when necessary.

Anyone familiar with this work will recognize that the procedure outlined calls for a tremendous amount of calculation. Frankly, we would not feel that we could

afford to make all of the computations involved if we did not have an electronic digital computer to do it for us. I should like to list and briefly describe the computer programs which we have adapted or written for use with the Bendix G-15.

Traverse Program

Given the distances, bearings, and terminal coordinates, the program will automatically compute and balance the traverse by the compass rule, transit rule, or least squares and print out corrected distances, bearings, and coordinates, or it can be used to compute and print out the length and bearing of an unknown side.

Centerline and Stationing Program

Given the P.I. coordinates, curve radii, and spiral lengths, if any, and a beginning station, the program will compute all curve data, coordinates and stationing of P.C.'s, P.T.'s, S.C.'s, S.T.'s, etc., tangent bearings, and coordinates of stations at any interval selected.

Distances and Bearings

Given the coordinates of consecutive points, the program will print out the distances and bearings between these points.

Intersections

Given the geometrics of an appropriate segment of the centerline and one coordinate and the bearing of an intersecting line, the program will print out the distance along the intersecting line from the point in question to the centerline and the station of the point of intersection.

Station and Offset

Given the coordinates of a series of points and the geometrics of the centerline, the station plus and offset of each point is printed back.

Parcel Data

Given the traverse of a closed figure or the corner coordinates, the area is computed.

Our computer section has virtually reduced our survey computations to a matter of filling out forms and waiting for the answers which are returned to us in minutes. It has made possible the checking and rechecking of traverse networks in many ways that would not be attempted if conventional computations were relied upon.

Referring again to the topographic maps which are obtained by photogrammetric methods, we have also been able to put them to good use in the troublesome problem of locating or establishing section and quarter-section corners. The topographic maps show fences very clearly and, having the ownership plats, we, of course, know which fences are supposed to be property-line fences—many of which are intended to be on section lines, quarter lines and other fractional section lines. When we are faced with the problem of establishing a corner, it is very convenient to scale from fence line to fence line and test the proportional relationships of the distances. The old fences, tree rows, abandoned roads, etc., that show up on the maps often provide valuable timesaving clues as to where to start looking for corner monuments. Thus information can be obtained in minutes that a field party would take hours to produce.

Aerial surveying has not eliminated ground surveying as the foregoing has pointed out. It has greatly increased the amount of information that it is possible to have on hand for a given project and materially cut down on the field-party time required. In evaluating the advantages of photogrammetry in highway work, the emphasis should be placed on the higher quality of engineering that it enables us to do, rather than on how many dollars are saved on the survey costs alone. When this yardstick is applied, the new methods are far ahead and increasing their lead every day.

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IT IS NOT TOO EARLY TO BEGIN PLANNING TO ATTEND THE 1961 MEETINGS

AREA OF FEDERALLY OWNED LANDS

(as of June 30, 1958)

State	Acreage owned by the Federal Government			Acreage not owned by Federal Government	Total acreage of State	Percent owned by Federal Government [1]
	Public domain	Acquired by other methods	Total			
Alabama	75,303.0	999,654.9	1,074,957.9	31,614,962.1	32,689,920	3.3
Arizona	32,183,138.7	231,496.2	32,414,634.9	40,273,365.1	72,688,000	44.6
Arkansas	1,070,928.6	1,908,444.1	2,979,372.7	30,732,627.3	33,712,000	8.8
California	44,283,987.5	1,910,816.5	46,194,804.0	54,118,796.0	100,313,600	46.1
Colorado	23,116,505.5	899,914.3	24,016,419.8	42,493,660.2	66,510,080	36.1
Connecticut		5,422.2	5,422.2	3,129,937.8	3,135,360	.2
Delaware		31,855.1	31,855.1	1,234,064.9	1,265,920	2.5
District of Columbia		11,211.7	11,211.7	27,828.3	39,040	28.7
Florida	324,003.3	3,029,307.7	3,353,311.0	31,374,369.0	34,727,680	9.7
Georgia		1,998,494.8	1,998,494.8	35,430,625.2	37,429,120	5.3
Idaho	33,896,584.0	589,975.2	34,486,559.2	18,485,600.8	52,972,160	65.1
Illinois	736.8	411,512.5	412,249.3	35,386,150.7	35,798,400	1.2
Indiana	80.0	334,546.0	334,626.0	22,836,574.0	23,171,200	1.4
Iowa	333.7	121,910.1	122,243.8	35,746,556.2	35,868,800	.3
Kansas	26,956.0	313,586.1	340,542.1	52,208,577.9	52,549,120	.6
Kentucky		973,324.9	973,324.9	24,539,635.1	25,512,960	3.8
Louisiana	23,541.3	1,039,662.7	1,063,204.0	27,840,476.0	28,903,680	3.7
Maine		124,902.5	124,902.5	19,740,697.5	19,865,600	.6
Maryland		223,397.6	223,397.6	6,100,442.4	6,323,840	3.5
Massachusetts		58,048.5	58,048.5	4,976,831.5	5,034,880	1.2
Michigan	288,054.6	2,949,871.2	3,237,925.8	33,256,154.2	36,494,080	8.9
Minnesota	1,361,788.2	1,902,353.0	3,264,141.2	47,941,618.8	51,205,760	6.4
Mississippi	13,391.3	1,496,416.2	1,509,807.5	28,728,912.5	30,238,720	5.0
Missouri	3,114.9	1,668,210.2	1,671,325.1	42,633,314.9	44,304,640	3.8
Montana	25,608,375.5	2,410,200.6	28,018,576.1	65,343,343.9	93,361,920	30.0
Nebraska	253,150.8	441,816.2	694,967.0	48,369,353.0	49,064,320	1.4
Nevada	61,105,432.3	538,572.8	61,644,005.1	8,620,954.9	70,264,960	87.7
New Hampshire		695,302.1	695,302.1	5,075,577.9	5,770,880	12.0
New Jersey		97,228.1	97,228.1	4,716,851.9	4,814,080	2.0
New Mexico	25,777,479.8	1,715,714.9	27,493,194.7	50,273,845.3	77,767,040	35.4
New York		258,518.9	258,518.9	30,425,641.1	30,684,160	.8
North Carolina		1,878,575.1	1,878,575.1	29,543,504.9	31,422,080	6.0
North Dakota	205,215.5	1,722,212.5	1,927,428.0	42,909,052.0	44,836,480	4.3
Ohio	85.0	204,378.8	204,463.8	26,035,536.2	26,240,000	.8
Oklahoma	164,019.1	829,108.4	993,127.5	43,186,712.5	44,179,840	2.2
Oregon	30,654,337.6	956,149.9	31,610,487.5	30,031,112.5	61,641,600	51.3
Pennsylvania		549,407.2	549,407.2	28,279,392.8	28,828,800	1.9
Rhode Island		7,793.7	7,793.7	669,326.3	677,120	1.2
South Carolina		1,084,004.5	1,084,004.5	18,311,195.5	19,395,200	5.6
South Dakota	1,585,815.4	1,614,532.4	3,200,347.8	45,782,692.2	48,983,040	6.5
Tennessee		1,569,791.3	1,569,791.3	25,180,288.7	26,750,080	5.9
Texas		2,630,049.2	2,630,049.2	166,018,270.8	168,648,320	1.6
Utah	36,114,008.8	370,258.4	36,484,267.2	16,217,172.8	52,701,440	69.2
Vermont		247,773.6	247,773.6	5,690,146.4	5,937,920	4.2
Virginia		2,122,463.7	2,122,463.7	23,409,056.3	25,531,520	8.3
Washington	11,350,584.0	1,318,555.4	12,669,139.4	30,073,900.6	42,743,040	29.6
West Virginia		933,954.0	933,954.0	14,477,246.0	15,411,200	6.1
Wisconsin	11,235.3	1,770,670.7	1,781,906.0	33,229,294.0	35,011,200	5.1
Wyoming	29,159,007.3	694,837.6	29,853,844.9	32,549,995.1	62,403,840	47.8
TOTAL	358,657,193.8	49,896,204.2	408,553,398.0	1,495,271,242.0	1,903,824,640	21.5
Alaska	362,670,637.9	2,775.8	362,673,413.7	2,808,186.3	365,481,600	99.2

[1] Excludes Trust Properties.

Source General Services Administration.

The above table is reproduced from *Our Public Lands* (Quarterly publication of the Bureau of Land Management, U. S. Department of the Interior) April 1959, Vol. 8, No. 4, page 16.

Instrumentman Training Program

By DON ZIERATH

PERSONNEL ENGINEER, IOWA STATE HIGHWAY COMMISSION

ON January 4, 1960, the fifth class will begin a ten-weeks course of instruction in the instrument work involved in highway surveying. The Instrumentman Training Course has proved very valuable in many respects. This is substantiated by the fact that this will be the fifth year that it will be offered. I understand that from time to time at your Conferences you have had reports on this course, and I know that you have heard of the course periodically through invitations to have some of your men attend. I would, therefore, like to use the time available today to point out two features of the course that the Highway Commission and their engineers feel are very important and worthwhile.

The first feature is the quality of training. The course was developed by and is administered by the Engineering Extension Service of Iowa State University. This course is not amateur effort. It is a professional product and stands very high, we believe, in the field of technician training. The instructors, who are graduate and/or registered engineers from the residency offices of the Commission, attend a two-day school before the course begins each year to learn how to teach an adult group such as this. The instructors for this year's course will come to Ames December 17th and 18th and spend two days going over the material of the course with a man from the Psychology Department of Iowa State University who will instruct them in teaching methods.

The course material is reviewed annually and is being improved by addition, deletion, and shifting all the time. As an example, we found that approximately one-third of the graduates become inspectors. There are several reasons for this, not the least of which is the personality and aptitude for supervisory responsibility of the individual student. Some men just make better inspectors than they do instrumentmen or party chiefs. The important point here is that, when we recognized this, the course was modified accordingly.

Four half days are now devoted to instruction covering inspection procedures and problems, with a full day inspection trip to projects in progress. Here also, the instructors are engineers fully qualified in their fields.

In recognizing this, we do not mean to admit that the money spent in training the men who became inspectors was wasted. To the contrary, these men were better inspectors because of their understanding of surveying, their ability to read blueprints, and their ability to read stakes and interpret them accurately.

The course itself is very intensive. The class load is seven hours a day with home work assignments that keep the students busy for an additional two to four or five hours a night. I am sure everyone realizes that this is more intensive than even a college curriculum. Another important point is that the class work is not just "book learning" but is heavily loaded with practical application.

The second feature that we feel is definitely worthwhile is the results we have come to expect from the graduates of the course. An even 250 men from our construction offices have graduated from the course, plus 18 from our preliminary survey parties. Of the 250 from construction, 203 are still on the payroll which, taking all items into consideration, is a lower turnover rate than that for any other single group of employees in our organization.

We have found that the graduates are qualified to handle independently any type of survey problem that is encountered in

Presented at the Thirtieth Annual County Engineers Conference, November 30 to December 2, 1959.

highway construction. Their ability is somewhat limited in complexity. Most of the men are limited in their ability to handle a party of men. This, of course, is primarily due to lack of supervisory ability and a lack of confidence on the part of a young man. This can be seen in the fact that 12 of the 48 graduates from the class of 1956 are Party Chiefs while only 2 of the 55 graduates from the class of 1959 are Party Chiefs. Recognizing this, most of the Resident Engineers assign the graduates that are going into surveying work as Instrumentmen on parties with experienced Party Chiefs for the first season to get additional experience and to gain the confidence they need. By the time the second season rolls around, most of the men are ready for parties of their own.

To complete the statistics, here is the breakdown of the men who have attended the courses from the construction offices.

250 Total attended

88 Inspectors

75 Instrumentmen
33 Party Chiefs
7 Office
203 Still employed

16 entered College
7 entered Military Service
7 entered the ranks of unemployed
17 resigned for miscellaneous reasons
47 no longer on the payroll

There is no other place within the State where a man has the opportunity to receive the intensive training in the specific field encompassed by this course. The only alternative to this type of training is on-the-job by yourself or the men on your staff. This we all allow is time consuming and spotty at best.

Without reservation we feel that this course has been a success beyond all expectations. The annual Instrumentman Training Course has been and is playing a real part in reducing the shortage of qualified technicians.

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Electronic Third Man on a Survey Party

By C. A. WOOLDRIDGE, JR.*

SURVEYING and engineering, like any businesses today, are constantly faced with the problem of economy. The business man who is not continually on guard for new methods or innovations to keep his costs to a minimum will soon find that competition has put him out of business.

This was our thinking when we first became interested in the possible use of a portable tape recorder to replace a man on the survey party. The literature advertising a battery-operated, three-pound tape recorder that could be operated anyplace was certainly appealing. The next question was, "what part of survey-party operations could make practical and economical use of a tape recorder?"

Stadia topography, where the speed of the party is frequently controlled primarily by the speed of the recorder, held special interest and, to date, has proven the most practical for use of a tape recorder. The detail is never quite as complete as one would like, and the average stadia party is continually limited in speed to how fast the recorder can write legibly. This results, as often as not, in incomplete detail, and an expensive waste of manpower and equipment.

Two models of tape recorders were tried, rather extensively, especially for the stadia operation. Certain drawbacks and limitations have made themselves felt, but we have concluded that the tape recorder can save up to 30 percent on some stadia operations. The principal drawback is that no permanent notes of the survey will exist. (The magazine with its tape can be stored, or the tape can be removed from the magazine, if a permanent record is considered important.) This lack of permanent record is particularly disadvantageous in case of questions or possible error, so, to date, we have followed a practice of keeping normal written notes covering the control portion of the work for establishment of topographic stations, and also written bench-mark levels. Only the actual stadia notes of topographic shots are recorded on the tape recorder with a considerable amount of additional descriptive detail.

One model had to be rewound by hand, which was a definite limitation insofar as transcribing the notes later was concerned. This same machine "coasts" after the switch has been turned off, which poses considerable difficulty in office transcription. It "coasts" only an inch, about half a word, but this can interfere with the understanding and slow down the plotting operation. In noisy localities, the background noise necessitates the use of a throat microphone. Our most important innovation was the switch the transit man must necessarily have to keep both hands free. Standard equipment with both tape recorders consisted of a hand-held microphone with built-in switch. This office finally devised a small, pressure-sensitive switch, mounted in a plastic box and strapped to the palm of the hand with a band of elastic. All of the manufacturers came up with a similar device which is probably as adequate.

In field use, the microphone is clipped to the lapel of the transitman, the switch mounted in the palm of the hand, and the three-pound recorder carried in the leather case over the shoulder. From this point on, the survey crew proceeds as on any topographic survey, with the instrumentman calling out his stadia intervals, rod readings, and horizontal and vertical angles to the tape recorder instead of to his human recorder. He must repeat the description of the station to the tape recorder instead of relying on the human recorder to provide his own descriptions.

When the notes are brought into the office, the draftsman (wearing earphones to keep office background noise to a minimum) plots his points in the usual manner.

* Licensed Land Surveyor, P. O. Box 1012, Carmel, California.

The stadia interval is listed on a scratch pad (which goes into the file) as it is read. This listing of stadia intervals serves several purposes. After setting the horizontal angle on the drafting machine, the stadia interval must be reduced to horizontal distance for plotting. Then the difference in elevation is figured. Listing stadia intervals does away with the necessity of remembering and provides a list for possible reference in checking any questionable point. The few times that it becomes necessary to recheck some particular point, it is relatively easy to find it by scaling the horizontal distance and rewinding the tape, checking progress frequently, until that certain interval is found.

We estimate that, to date, we have accomplished about 30 percent cost reduction in stadia topography by use of a portable tape recorder. This is done by using either a two-man instead of a three-man party, or using a three-man party with two rodmen. There is no reason why base levels or profiles cannot be run with a tape recorder except that nine times out of ten, it is necessary at future dates to refer back to those levels. A saving of field time, if they must later be transcribed to written form in the office, does not seem practical. The complete boundary traverse and even lot surveys should be practical with a tape recorder, except, again, for the future need to refer to the notes. The tape recorder is used for, and does save time on, grid topographic elevations, cross sections, and contour stadia work. We store the tapes until we are satisfied, and our client is satisfied, that the map is correct and accurate. These tapes could be stored on the reels for an indefinite period of time at a very nominal investment in tapes. However, we have noted that notes worth permanent saving are going to be referred to and therefore should be on paper for easy viewing. It takes only a second or so to thumb through several pages of notes whereas the tape plays at only one speed.

A good portion of the work would have to be stadia topographic mapping to justify the purchase of a portable tape recorder. However, the fact that the machine may be used as a regular dictating machine in the office can certainly help justify its purchase. The lost hours behind the wheel of a car are salvaged also. This report, for instance, was dictated on the highway en route to review a job—time normally wasted. Just one more example of the economies that may be effected to help reduce costs in the competitive business world.

F. I. G.

The 1960 meeting of the Comite Permanent, International Federation of Surveyors—F.I.G. (Federation Internationale des Geometres)—was scheduled to take place in Brussels, Belgium, June 23–28, 1960.

This is the first meeting under the Austrian Bureau since the transfer of the administration at Cracow, Poland, last September.

Besides the routine administrative business of F. I. G., activities of the Technical Commissions and plans for the Tenth International Congress of Surveyors will be discussed.

The Tenth International Congress of Surveyors is scheduled to be held in Vienna, Austria, during the end of August and the beginning of September 1961, where Technical Commissions will meet at the Technological University of Vienna and the Official General Sessions, including the Ball and Banquet, will be held in the Neuen Wiener Hofburg, the scene of famous Court Balls in the time of the Monarchy. Exhibits are planned in the Technical Museum near Schonbrunn. Vienna's musical and theatrical season commences at the same time.

A Diagram for Determining the Excess of a Spherical Triangle

By KURT BRETTERBAUER

INSTITUTE OF GEODESY, PHOTOGRAMMETRY AND CARTOGRAPHY,
OHIO STATE UNIVERSITY*

THE SURVEYOR often finds himself confronted with the problem of determining the excess of a spherical triangle. This is necessary for finding the closure of a triangle, for the application of Legendre's Theorem, etc. The computation of the excess from the area of the triangle is not always convenient, particularly if the triangulation points are given in geographic coordinates.

Having identified the triangulation points on a small-scale map, a simple diagram can be used to determine the spherical excess, accurately enough for all practical purposes, without any computation. The excess is given very closely by the formula

$$\varepsilon'' = \frac{F}{R^2 \sin 1''} \text{ with } R = \sqrt{MN}$$

F being the area of the triangle, M the radius of curvature in the meridian, and N the radius of curvature in the prime vertical. First we shall investigate how a small change in R influences ϵ. It is

$$\frac{\Delta\varepsilon}{\varepsilon} = \frac{-2\Delta R}{R}$$

That means that an error of 3.2 km in R creates a corresponding error of 1 in 1000 in ϵ. For the purpose of our diagram it is sufficient to assume an average value of R. R at latitude 40° is 6375 km. The use of this average value introduces an error in ϵ of +0.32 percent at 25° latitude and of −0.23 percent at 50° latitude. These errors are not significant since the excess depends on the true conditions of the curvature of the geoid, which can be quite different from that of the ellipsoid. A strict determination of the excess would demand the consideration of the deflections of the plumb lines.

Thus, we consider the excess to be equal to the area times a constant which is $1 \div R^2 \sin 1''$. For the computation of the area we treat the triangle as in a plane. Then the area is the half of the product of base times the height, that is

$$F = \frac{bh}{2}$$

In a rectangular coordinate system with the axes b and h, the lines of equal area are represented by equilateral hyperbolas. Since the excess is proportional to the area, these hyperbolas also represent lines of equal excess, and we have only to number them in a different manner. The hyperbolas can be plotted on a transparent sheet.

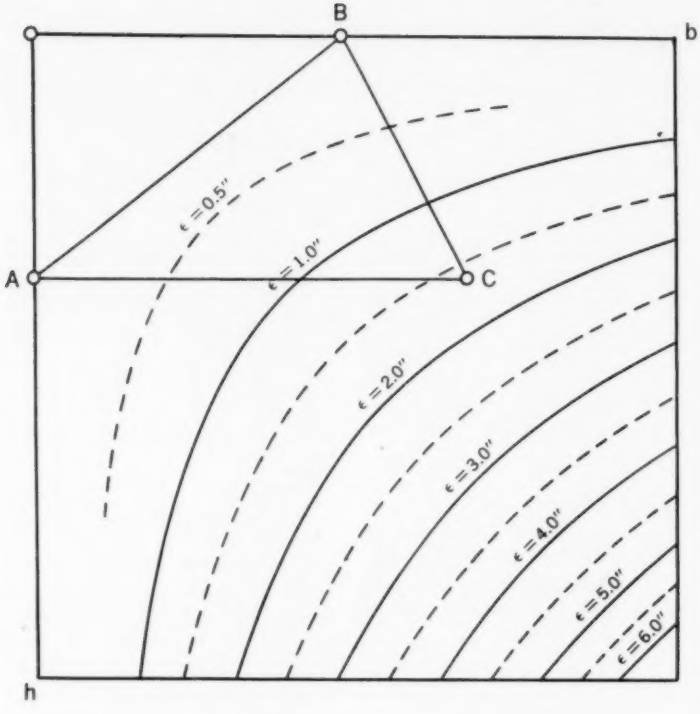
Figure 1 shows the completed diagram at a scale of 1:500,000. For practical usage however, I suggest the scale 1:250,000. At this scale it is possible to estimate one-hundredth of a second. The computation and construction of the diagram is quite simple and can be done by anybody in a rather short time.

THE APPLICATION OF THE DIAGRAM

The diagram is superimposed on a map in such a way that one corner of the triangle lies in the b axis, another corner in the h axis, and one side is parallel to the b axis. Then the position of the third corner between the hyperbolas determines the spherical excess (in the figure, the excess is 1.7″.)

In theory, the application of the diagram requires the use of an equal-area projection. Some maps of the United States are based on the polyconic projection, which does not give equal areas. However, the distortion of an area is, in percentage, very closely described by the formula

* Appointment supported by the International Cooperation Administration under the Visiting Research Scientists Program administered by the National Academy of Sciences.



$$E = \left(\frac{1^\circ \cos \phi}{8.1}\right)^2$$

ϕ being the geographic latitude and 1° the distance from the central meridian in degrees. The maximum error for the 1° by 1° sheets of the 1:250,000 topographic map series is less than 0.004 percent.

It may be pointed out here that for the determination of the spherical excess from a map we also could use a polar planimeter. By interpreting $1/R^2 \sin 1''$ as a scale factor we can always adjust the planimeter in such a way that, after having traced the triangle, the counter wheel shows the excess directly.

₹ ₹ ₹

Wild-Heerbrugg Award

Reference is made to the previous publication of information concerning the Wild-Heerbrugg Award and the Deed of Award in SURVEYING AND MAPPING, March 1960, Vol. XX, No. 1, page 133–134.

ACSM President H. Arnold Karo has appointed, with the approval of the Board of Direction, the following to act as a board of judges to consider papers submitted for consideration for the first award in March 1961:

Howard S. Rappleye, Editor-in-Chief, SURVEYING AND MAPPING (Chairman),

Charles A. Whitten, Chairman, Publications Committee, ACSM, and

Robert C. Eller, formerly Editor-in-Chief, SURVEYING AND MAPPING.

The deadline for submission of papers to be considered for the first award will be January 31, 1961. (*See* Deed of Award, Article III, Section C.)

Crisscross

By CURTIS M. BROWN

DANIELS, BROWN AND HALL, SAN DIEGO, CALIFORNIA

THE "CRISSCROSS" computation is a time saver. In attempting to determine the history of this useful mathematical tool, I have traced the solution back to at least 1923. H. L. Edwards (Edwards Engineering Company, San Diego, California) states that he and his associates, when working for the Boulevard Land Company, independently developed the formula. He does not know whether others had previously "discovered" the method, but he is sure that their solution was independent of previous writings. It would be interesting to know how many have actually independently "discovered" this process.

To my knowledge, other than in the November 1958 issue of *Civil Engineering* (by John F. Tanner), the crisscross method has not appeared in publication. Since it is a definite timesaver, repetition here is worth while for those not acquainted with the procedure.

The crisscross can be used (1) solving the lengths of two intersecting lines with known bearings or (2) for solving the unknown elements of two lines, one with a known bearing and the other with a known length. The first solution is:

Given: (1) the difference in coordinates of two points *A* and *B* (*See* Figures 1A and 1B) and (2) the bearings of two lines, *AC* and *BC*, originating at points *A* and *B*.

Wanted: The length of line *AC* and the length of line *BC*.

Solution: If *N* is the coordinate difference in a north-south direction, *E* is the coordinate difference in an east-west direction, α is the bearing angle for line *AC*, and β is the bearing angle for the line *BC*, then in Figure 1A the length of AC is computed as follows:

$$AC = \frac{H}{\sin \Delta}$$

$$H = E \cos \beta - N \sin \beta$$

$$AC = \frac{E \cos \beta - N \sin \beta}{\sin \Delta} \qquad (1)$$

In Figure 1B the length of *BC* is computed as follows:

$$BC = \frac{E \cos \alpha + N \sin \alpha}{\sin \Delta} \qquad (2)$$

Many possible combinations of angles and lines exist. *AC* and *BC* may be in the same quadrants or in opposite quadrants. The

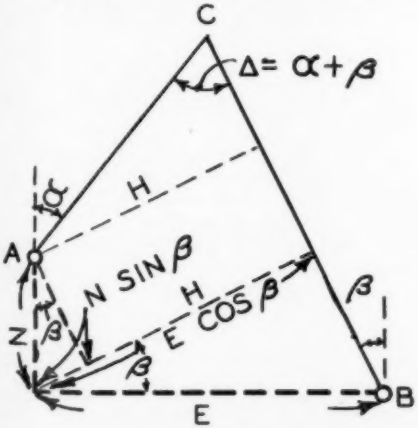


FIGURE 1A.

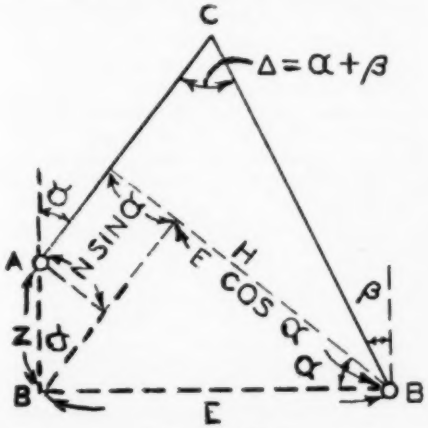


FIGURE 1B.

delta angle may be more or less than 90°. When solving the problem for all conditions, it will be found that the general equations are:

$$AC = \frac{E \cos \beta \pm N \sin \beta}{\sin \Delta}$$

$$BC = \frac{E \cos \alpha \pm N \sin \alpha}{\sin \Delta}$$

When referring to either Figure 1A or Figure 1B or any other condition, the rule for determining the signs in these general formulas is:

When solving for *AC*, if lines *AB* and *BC* are in the same quadrant (NE, NE; or NE, SW; or NW, SE; or SE, SE) the sign is always minus, but if *AB* and *BC* are in opposite quadrants (NE, NW; or NE, SE; or SE, SW; or SW, NW) the sign is plus.

The reason for the name crisscross is obvious. When computing one side, the bearing of the other side is used, and vice versa.

The second application of the crisscross is for the curve intersection problem. If *AC* (Figure 1A) is the radius (*R*) of a curve and the direction of *BC* is given, delta can be solved for by:

$$\sin \Delta = \frac{E \cos \beta - N \sin \beta}{R}$$

In the general formula the minus sign becomes either plus or minus and is determined by the same rule as given above (same quadrants, minus; opposite quadrants, plus). When computing subdivision maps, this formula is a "must" for all computers.

Attention: American Universities and Colleges

Canada's challenge to its universities on the matter of education for surveyors is equally apropos in these United States in admonition to its schools and colleges. The following article, reprinted by permission, from the *Canadian Weekly Bulletin*, Information Division, Department of External Affairs, Ottawa, Canada, November 18, 1959, Vol. 14, No. 46, puts the matter quite clearly.

EDUCATION FOR SURVEYORS

Canada's surveyors must raise their educational standards if they are to keep pace with today's revolution in survey science and maintain their professional status. And they feel that Canadian universities should seriously consider giving more emphasis to surveying.

This was the consensus of the 70 delegates attending a recent colloquium on survey education in Ottawa. The gathering, called by the Canadian Institute of Surveying in conjunction with the Department of Mines and Technical Surveys and the National Research Council, studied the serious lack of adequately-trained surveyors, at a time when they are vitally needed in the development of Canada's resources, particularly in the north.

The delegates came from federal and provincial governments, survey associations, industry, and from Canadian, United States and English universities.

"In the last 50 years surveying has undergone a revolution and become a science with new techniques and new instruments," said Armand Dumas, Q. L. S., President of the Institute and M. P. for Villeneuve, Quebec. "We now need a Moses to lead us out of the wilderness so we are throwing out a challenge to our universities to help us, and we are sure they will take it up."

Speaking on the great need for adequately trained surveyors to carry out the mapping so necessary to national development, Dr. van Steenburgh, Director-General of Scientific Services, Department of Mines and Technical Surveys, pointed out that, because of the difficulty of recruiting such staff, the Department, as the federal mapping agency, has to devote "a very considerable amount of time to on-the-job training. Even the civil engineer graduates go through a form of apprenticeship before being charged with the responsibility of heading up field parties."

A comparison of the surveyor of yesteryear and of today was made by Dr. L. E. Howlett, Director of the Division of Applied Science, National Research Council.

"Fifty years ago, a man with a tape, theodolite, level, staff, compass and a few other odds and ends could with justice call himself a surveyor if he combined with these a modicum of mathematics and a smattering of local law. Today, surveying has swept far beyond this, and the surveyor must be a professionally trained man with vision, and he must possess a fundamental knowledge and understanding of new scientific instruments and techniques."

"Point of Beginning" Commemoration

On Sunday, April 10, 1960, a group of interested persons visited the vicinity of the "Point of Beginning" of the public-lands surveys in the United States—the east end of "The Geographer's Line," near where the Ohio-Pennsylvania boundary reaches the north bank of the Ohio River—to further plans for suitable ceremonies to commemorate the 175th anniversary of the establishment of that point in 1785.

The story of the gathering and the plans for the commemorative ceremonies were covered in an article by Robert Popp, published in the *East Liverpool Review* of April 11, 1960. The picture reproduced below was published in the *Review* as a part of Mr. Popp's article. Both Mr. Popp's article and the photograph have been republished with pemission. —EDITOR

Photo by Byron R. Eells, East Liverpool Review

THE "TERMINAL POINT" PLACED IN 1881 ON THE OHIO-PENNSYLVANIA BOUNDARY.

Left to right: E. L. Calland, General Manager, H. R. Allen Co., Beaver; Harold B. Barth, Curator, East Liverpool Historical Society Museum; Attorney William H. Vodrey, Jr., local historian; George S. Bloomgren, City Engineer, East Liverpool; Jean Pomeroy; William Pomeroy, Jr.; Professor Ralph Moore Berry, University of Michigan; and W. B. Williams, Civil Engineer, Grand Rapids, Michigan, and Past President of the Ameican Congress on Surveying and Mapping.

CEREMONY SLATED FOR HISTORIC SITE

By ROBERT POPP

The attention of surveyors, engineers, and historians all over the nation will center on East Liverpool this fall for a ceremony marking the 175th anniversary of the placing of a marker that served as the point of beginning for marking out "the greatest subdivision on earth," the western public lands of the United States.

Preparations for the observance moved ahead Sunday when two representatives of the American Congress on Surveying and Mapping came to East Liverpool to visit the obscure spot near the riverfront at the Ohio-Pennsylvania state line where the marker was placed.

Ralph Moore Berry of the College of Engi-

neering at the University of Michigan and W. B. Williams, a civil engineer at Grand Rapids, met with City Engineer George S. Bloomgren, H. B. Barth, curator of the East Liverpool Historical Society Museum, and Atty. William H. Vodrey, Jr., a regional historian.

The "point of beginning" was established on August 20, 1785, by a party of surveyors who "set a stake on the flat, north side of the Ohio River."

What was once a spot in an Indian-infested wilderness and part of the public lands that soon would be offered for sale to help a debt-ridden national government now is a flat stretch of leveled slag fill that lies just a few hundred feet below Harvey Avenue. The stake that the survey party drove long since has disappeared and Bloomgren said the best evidence indicates that it was a wooden marker that would have rotted away within a few years at best.

Still standing near the site is a heavy granite monument that was erected in 1881 by a joint commission appointed by the states of Pennsylvania and Ohio to remark the boundary line between the two states. The party visited the monument Sunday afternoon and made tentative plans for moving it to a new site alongside Harvey Avenue, as a highlight of the observance of the 175th anniversary of the establishment of the "point of beginning."

The monument stands nearly 6 feet high. Cut into the side which faces Harvey Avenue is the notation: "Erected in 1881 by a joint commission appointed by the states of Ohio and Pennsylvania to resurvey and remark the boundary line as established in 1786."

The monument sits on a square base, with the words "Ohio" and "Pennsylvania" cut into opposite sides. The group that visited the monument yesterday said a bronze plaque might be set into one of its sides when it is relocated, explaining that a short distance south of the new site was established the "point of beginning" for the public land surveys.

The 1881 boundary marker is in an obscure and almost inaccessible spot, as it is surrounded closely on three sides by the slag fill, which rises to a height of 50 or 60 feet. The sloping sides of the slag fill form a U-shaped enclosure in which the boundary marker sits, surrounded by several large trees, some brush and some debris.

The "point of beginning" was established under the Land Ordinance of 1785, in which Congress provided for the sale of public lands in the west as a way of removing burdensome public debt. The territory was to be surveyed into townships of about 26,000 [*sic*] acres each.

From the point on the Ohio River bank here, a line was surveyed due west a distance of about 42 miles. It later became known as the "geographer's line." Every six miles along the "geographer's line," a party of surveyors moved southward, surveying a north-south line to the Ohio River. These lines formed the boundaries for the several ranges of townships. Later east-west lines were run at six-mile intervals, forming the tiers of townships each six miles square.

The surveying work was in charge of Thomas Hutchins, head of the "Geographer's Department," who earlier—as a British officer—had served at Fort Pitt and had made exploratory expeditions from that point north to Lake Erie, overland to Lake Michigan and the upper Wabash Valley, and down the Ohio River to the Mississippi.

His general map of the west, compiled as a result of the expeditions, had established him as an authority on the area. The map served to guide the surveyors when they moved into the new country.

The surveying party gathered at Pittsburgh, where provisions, horses, and workers had been collected. Then it moved downstream and camped at the mouth of Beaver Creek, near the "point of beginning."

The story of the survey is told in great detail in the book, "The Beginnings of the American Rectangular Land Survey System," by William D. Pattison, published by the University of Chicago Press.

Starting September 30 at the initial point established in 1785, Hutchins complied with the instructions in the Land Ordinance to personally supervise the running of the first east and west line. His party moved forward until October 8, covering only four miles of the base line, when work was called off because of "disagreeable intelligence concerning the Indians."

That was the end of the work in the first season. The surveying resumed August 9, 1876. It was interrupted again on September 18 by new fears of an Indian uprising. The work resumed later in the season, but was interrupted again by cold weather. Work pushed ahead rapidly in 1787 and 1788 and in July, 1788, Hutchins submitted his general plan and notes and plats to the federal government, ending the first phase of the U. S. public land surveying.

Typical of government projects, the surveying cost three times as much—and required three times as long—as Congress had anticipated. The over-all cost was computed at $14,876, including $5,553 for the geographer's salary.

The only sale of land in the so-called "Seven

Ranges" took place in New York City in late September 1787. Congress authorized the sale, although by that time the survey data had been received on only the first four ranges of townships.

About a third of the land was sold at an average price of $1.26 an acre. The total price for 30 purchases was $176,090.

In his book, Pattison comments that "field work in the Seven Ranges, isolated though it was in many ways, exerted a lasting influence upon subsequent surveying. In justice it must be placed alongside the Land Ordinance of 1785 as a separate part of the foundation of the American rectangular land survey system."

Professor Berry said the observance here may be held on September 30, the anniversary of the date that the survey party began to move west to mark off the "geographer's line." However, no definite plans have been made for the observance, he said, explaining that the weekend meeting here was "purely exploratory."

The party that gathered around the monument at the state line included Jean Pomeroy and William Pomeroy, Jr., of East Liverpool and E. L. Calland, general manager of the H. R. Allen Co., of Beaver, which has made the slag fill on the industrial site. Calland said his concern was careful not to allow the fill to intrude on the monument's site.

Conclusions of exploratory conversations between the East Liverpool Historical Society and the committee of the American Congress on Surveying and Mapping, as reported to the Executive Secretary, ACSM, are set forth below. The participants in the conversations were: Harold B. Barth, George S. Bloomgren and William H. Vodrey, Jr., for the East Liverpool Historical Society; and Ralph Moore Berry, and W. B. Williams, for the ACSM.

A. The "Point of Beginning" of the first U. S. Public Land Surveys was at the east end of the "Geographer's Line," at a point on the Ohio-Pennsylvania boundary, at the north bank of the Ohio River. This point, not now marked, was originally intended to be perpetuated with a suitable monument by ACSM. Near this point (several hundred feet north) is a large appropriately inscribed monument, set on the Ohio-Pennsylvania boundary by a joint commission in 1881. This monument is the "southern terminal" monument of the 1881 resurvey. Both the "Point of Beginning" and the "southern terminal" monument are now in the midst of an extensive slag dump where the conditions are not suitable for future preservation. After inspection of the site, it is agreed: (1) that it is not practicable to monument the site of the "Point of Beginning," and (2) that immediate steps should be taken to preserve the "southern terminal" monument. It was decided that the best solution is to remove the "southern terminal" monument from its present position (leaving the original rectangular base stone in place) to a new location on the Ohio-Pennsylvania line approximately three hundred feet north of its present position, and on the south edge of the present Highway 68. A new granite base will be procured and the original 1881 pylon placed on it with its original lettering undisturbed. The new base will have suitable lettering (cut into the stone or cast in bronze plaques) to state the number of feet that the new position is from the original location. Another note will state that this action was accomplished by joint action of the East Liverpool Historical Society and the American Congress on Surveying and Mapping.

B. Mr. Bloomgren will undertake to retrace the "Geographer's Line" eastward a mile or more from existing accepted marks on it, to its intersection with the Ohio-Pennsylvania line. This position will be accepted as the location of the "Point of Beginning." It is expected that this intersection will fall several hundred feet south of the present "southern terminal" monument. Mr. Bloomgren will also determine by survey the point on the edge of the highway to the north, and on the Ohio-Pennsylvania line, where the "southern terminal" monument can be conveniently placed, and measure the distance to this point from the present location of the monument. This will provide the figures to be inserted in the note on the new base. Another note will state that the "Point of Beginning" was south of the new position of the "southern terminal" monument, and state the actual number of feet as determined by Mr. Bloomgren's survey. Mr. Bloomgren will be reimbursed by ACSM for his actual out-of-pocket payroll costs for this surveying.

C. The Historical Society will attempt to purchase, from the private proprietor, a small parcel of ground on the south margin of the highway where the relocated monument will be set.

D. If the purchase can be accomplished, the Ohio and Pennsylvania highway departments will be contacted and asked to assume jurisdiction and maintain a roadside park at the site.

E. A suitable ceremony will be planned to

dedicate the site on 30 September 1960, the 175th anniversary of the first surveying operations on the "Geographer's Line." Plans will generally be developed by the Historical Society, but Professor Berry will arrange for speakers from the ACSM and the Bureau of Land Management.

F. Professor Berry will undertake to write a short background sketch of the surveys commemorated, suitable for inclusion in a program to be distributed. It will be attempted to get this material published in the next issue of SURVEYING AND MAPPING, so that reports can be ordered for distribution.

G. East Liverpool Historical Society will contact the Western Pennsylvania Historical Society (Pittsburgh) about possible participation in the dedication ceremonies.

Army Map Service Semicentennial

The Army Map Service, of the Corps of Engineers, U. S. Army, staged an outdoor meeting at 11:00 a.m., April 11, 1960, in front of its main building, Erskine Hall, to open the events of a week-long celebration in observance of the 50th anniversary of the establishment of a map reproduction unit at the Army War College, which, during the last half century, has grown from very humble beginnings to the present Army Map Service.

Colonel F. O. Diercks, Commanding Officer, Army Map Service, welcomed the large gathering and then introduced Lieutenant General E. C. Itschner, Chief of Engineers. General Itschner spoke briefly concerning the great strides made by the Army Map Service since its beginning and then introduced the Honorable Wilbur M. Brucker, Secretary of the Army.

Secretary Brucker spoke concerning the past history and accomplishments of the Army Map Service, as well as its present activities and the tasks it will probably face in the foreseeable future.

Awards of the Commendation Ribbon with Metal Pendant were made to Lieutenant Colonel James B. Meanor, Jr., and to Master Sergeant Frank Puncsak. Awards to civilian personnel of the Army Map Service included one "outstanding performance" award to Chester C. Slama and twelve "sustained superior performance" awards to five women and seven men.

Following the outdoor ceremonies, a group of distinguished guests made a tour of the Army Map Service for the purpose of seeing a variety of prepared exhibits as well as some of the regular operations of the various divisions into which the total activity of the Service is broken down for physical as well as administrative reasons.

Arrangements were made for other groups of interested persons to tour the plant during the remainder of the week.

The Army Map Service, which traces its history in military mapping back to the days of the Revolutionary War, specifically came into being in 1910 when space was provided in a warehouse at the Army War College, now Fort Leslie J. McNair, to accommodate a Map Reproduction Unit of the Corps of Engineers. Over the years, this evolved into the "Central Map Reproduction Plant," then into the "Engineer Reproduction Plant," and, finally, with the construction of the facilities at Brookmont in 1942, the "Army Map Service."

Presently, under arrangements of one form or another, the Army Map Service is cooperatively assisting some 47 nations of the free world in the accurate military mapping of large areas of the surface of the earth. In addition, its scientific and technological contributions have substantially helped other departments or agencies of the United States Government.

Approximately 2,700 civilians are employed at the Army Map Service Headquarters in addition to a military contingent. There are four field offices at Louisville, Kentucky; Kansas City, Missouri; Providence, Rhode Island; and San Antonio, Texas; which supplement the work accomplished at the headquarters at Brookmont, Md.

Thank You!

The following paragraph is quoted from a letter addressed to the American Congress on Surveying and Mapping by John P. Butler, Land Surveyor, 265 Jackson Avenue, Syosset, L. I., N. Y.

—EDITOR

Congratulations are in order to James L. Bell and fellow members of the Fees & Salaries Committee for the fine job they did on the "Fees & Salaries Study." Having access to information such as this is one more reason why I am proud to be a member of the ACSM, and I consider the reading material in our Journal as a vital part of my professional education.

Surveying and Mapping Literature

Members are requested to send in surveying and mapping news items for publication in SURVEYING AND MAPPING.—EDITOR.

MAGAZINE ARTICLES

General Interest

THE SURVEYORS OF QUEENSLAND. *The Australian Surveyor,* Vol. 17, No. 7, September 1959. (Historical article prepared by Queensland Division, the Institution of Surveyors, Australia, in connection with the celebration of the centenary of the establishment of that State.)

TRIANGULATION—A PRECISE METHOD FOR SATELLITE TRACKING. P. G. Kirmser and I. Wakabayashi, *Journal of the Franklin Institute,* Vol. 268, No. 5, November 1959. (Explanation of method, with diagrams and mathematical formulae.)

INTERNATIONAL OCEANOGRAPHIC CONGRESS. G. E. R. Deacon, *Nature* (London), Vol. 184, No. 4699, November 21, 1959. (Summary of the first International Oceanographic Congress, held at U. N. headquarters, August 31–September 11, 1959.)

ESSENTIALS FOR MAPPING THE MOON. Zdenek Kopal. *American Scientist,* Vol. 47, No. 4, December 1959. (Describes project for mapping the Moon by filming shadows cast by various points at sunrise and sunset, carried on by a group of astronomers from the University of Manchester under a grant from the U. S. Air Force in an observatory at a 9,400-foot altitude in the Hautes Pyrenees in France.)

THE 600-FOOT RADIO TELESCOPE. Edward F. McClain, Jr. *Scientific American,* Vol. 202, No. 1, January 1960. (Illustrated discussion of the construction, capabilities, and intended uses of the massive radio telescope being erected near Sugar Grove, West Virginia, with general comments on past achievements and progress in the field of radio astronomy.)

OHIO DEVELOPS SPECIFICATIONS FOR CONSULTING SERVICES. E. S. Preston. *Civil Engineering,* Vol. 30, No. 1, January 1960. (Summary of specifications presented by Director, Ohio Department of Highways, and covering all aspects of highway construction.)

CHARTING THE HIGHWAY PROGRAM THROUGH 1960. B. D. Bellamy. *Civil Engineering,* Vol. 30, No. 1, January 1960. (The Federal Highway Administrator summarizes progress in implementing the Federal-Aid Highway Act from July 1, 1956, to the present time.)

HARNESSING THE TIDES. Alden K. Sibley and William H. McNeice. *The Military Engineer,* Vol. 52, No. 345, January–February 1960. (Report on the feasibility of the Passamaquoddy tidal power project.)

SCIENTIFIC SURVEY IN WINYAH BAY. Rear Admiral H. Arnold Karo. *The International Hydrographic Review,* Vol. 37, No. 1, January 1960. (Describes work by the Coast and Geodetic Survey carried out in conjunction with the Corps of Engineers to discover causes of heavy rate of shoaling in navigational channels.)

ORGANIZATION AND TRAINING OF PERSONNEL OF THE PHILIPPINE COAST AND GEODETIC SURVEY, *The International Hydrographic Review,* Vol. 37, No. 1, January 1960. (Includes organization chart of the Survey.)

ORGANIZATION AND TRAINING OF THE PROFESSIONAL AND TECHNICAL PERSONNEL OF THE CANADIAN HYDROGRAPHIC SERVICE. *The International Hydrographic Review,* Vol. 37, No. 1, January 1960. (Describes standards for employment and nature of on-the-job training.)

POLYNESIAN NAVIGATION STONES. Captain Brett Hilder. *Navigation* (Journal of the Institute of Navigation), Vol. 6, No. 4, Winter 1959. (Interesting speculations on the use of markers found on Arorae in the Gilbert Islands which appear to point with high accuracy to various distant islands in the group.)

ENGINEERS AS CITIZENS. Paul Douglas. *Journal, Florida Engineering Society,* Vol. 13, No. 5, February 1960. (Analysis of the position of the professional engineer in modern society.)

THOUGHTS ON THE LIVING PROCESS. Kenneth Melvin. *New Zealand Surveyor,* Vol. 23, No. 1, February 1960. (Points up role of the surveyor in intensive planning and development of land resources essential to the production of food.)

DISTANCE MEASUREMENT. D. R. Brenchley. *New Zealand Surveyor,* Vol. 23, No. 1, February 1960. (Brief review of surveying methods and instruments.)

IMPORTANCE OF DRAFTING IN ENGINEERING DEVELOPMENT. Charles A. Chayne. *The Draftsman,* Vol. 7, No. 3, March 1960. (Statement from the Vice President in Charge of Engineering Staff, General Motors Corporation.)

ARMY MAP SERVICE SEMICENTENNIAL. Clifford E. Fleeharty. *The Military Engineer,* Vol. 52, No. 346, March–April 1960. (Traces devel-

opment from a small reproduction plant in a warehouse at the Army War College in 1910 to status as the leading international military mapping agency in the world.)

ENCLAVE IN COLORADO? Richard S. Patterson. *Our Public Lands,* Vol. 9, No. 4, April 1960. (Refutes the legend that a portion of the State of Colorado was never officially made a part of the United States.)

Cartography

NOMENCLATURE IN AUSTRALIA. Panel. *Cartography* (Published by the Australian Institute of Cartographers), Vol. 3, No. 1, March 1959. (Review of legisation governing place-name procedures in the various political subdivisions of Australia.)

THE VALUE AND USES OF MAPS. J. Middleton. *The Australian Surveyor,* Vol. 17, No. 7, September 1959. (General discussion addressed to New South Wales Division, Institution of Surveyors, Australia.)

ANIMATED CARTOGRAPHY. Norman J. W. Thrower. *The Professional Geographer,* Vol. 11, No. 6, November 1959.

METALLOGENIC MAPS. S. I. Tomkeieff. *Nature* (London), Vol. 184, No. 4700, November 28, 1959. (Brief note on progress in development of a map which relates distribution of mineral deposits to geologic structure.)

SOME POLAR BASIN MAPS. George H. Dalphin. *Bulletin No. 38, Geography and Map Division, Special Libraries Association,* December 1959. (Review of U. S. Navy Hydrographic Office *Oceanographic Atlas of the Polar Seas,* Part II, Arctic, 1958.)

AERO SERVICE CORPORATION. Rinehart S. Potts. *Bulletin No. 38, Geography and Map Division, Special Libraries Association,* December 1959. (Describes products and functions of world's largest aerial mapping company and oldest flying corporation.)

PHOTOGRAMMETRIC MAPPING OF THE BROOKS RANGE. Paul Blake. *Photogrammetric Engineering,* Vol. 25, No. 5, December 1959. (Brief review of background requirements for 1:250,000 scale maps of the Brooks Range, Alaska, problems faced in initial planning of the job, and detailed description of the photogrammetric operations in the Denver office of the Geological Survey.)

SOME THINGS TO KNOW ABOUT PAPER. W. Keith Gainer. *Modern Lithography,* Vol. 28, No. 1, January 1960. (Illustrated discussion of various paper problems including storage and pressroom handling.)

A NEW DEVELOPMENT IN PERCENTAGE SCREENS FOR LITHOGRAPHED MAPS. J. S. A. Schroder. *Modern Lithography,* Vol. 28, No. 1, January 1960. (Illustrated description of process for obtaining a greater range of shades in map reproduction.)

MAPS USED IN MINERAL INVESTIGATIONS. Bennie W. Troxel. *Mineral Information Service* (State of California, Division of Mines), Vol. 13, No. 2, February 1960. (Illustrated general discussion of various types of maps with emphasis on maps of California.)

A CIRCULAR RADIO FACILITY CHART. Capt. George M. Boyd, USAF. *Navigation* (Journal of the Institute of Navigation), Vol. 6, No. 4, Winter 1959. (Describes proposed "Dial-a-Base," a circular chart comprised of three sliding discs operating somewhat on the principle of the slide rule to facilitate almost instant distances and vectors in relation to radio navigation facilities for aircraft.)

GLOBAL NAVIGATION DISPLAY. Robert H. Courtney, Jr., Milton Goldin, and Marshall M. Risdon. *Navigation* (Journal of the Institute of Navigation), Vol. 6, No. 6, Summer 1959. (Describes development of a display technique utilizing a point-source lamp for projection through an optical quality globe to create a continuous cartographical display to save time in air navigation plotting.)

TOPOGRAPHIC MAPPING IN ANTARCTICA. George D. Whitmore. *Geographical Review,* Vol. 50, No. 2, April 1960. (Proposed procedure for small-scale mapping of Antarctica with discussion of equipment required, methods of compilation, alternative procedures and estimated cost.)

Control Surveys

THE GEODETIC SURVEY OF AUSTRALIA. A. F. Hrren. *Cartography* (Published by the Australian Institute of Cartographers), Vol. 3, No. 1, March 1959. (A brief history of geodetic surveying in Australia dating from 1828 through the establishment of a national survey in 1945.)

FIELD USE OF THE TELLUROMETER. C. K. Waller. *Cartography* (Published by the Australian Institute of Cartographers), Vol. 3, No. 1, March 1959. (Details of field tests of Tellurometer equipment in Australia.)

TELLUROMETER SURVEY ON THE WEST COAST. *The New Zealand Surveyor,* Vol. 25, No. 6, August 1959. (Description of a resurvey of a section of the New Zealand coast which had gone unmapped for 100 years.)

ON THE COMPUTATION OF THE POLE COORDINATES. E. P. Federov. *Bulletin Geodesique* (The Journal of the International Association of Geodesy), Annee 1959, No. 54, 1 Decembre 1959. (Discusses operation of the International Latitude Service and suggests two principal methods of computation of polar coordinates on the basis of available data from the various stations.)

TRAVERSE IN FRENCH HYDROGRAPHIC SURVEYS BY GEODIMETER AND TELLUROMETER. An-

dre Brunel, Assistant Hydrographer of the French Navy. *The International Hydrographic Review,* Vol. 37, No. 1, January 1960. (Describes methods which are efficient and effective especially in difficult tropical areas.)

On the Publication and Reduction of the Latitude Observations Made During the International Geophysical Year. E. P. Federov. *Bulletin Geodesique* (The Journal of the International Association of Geodesy), Annee 1959, No. 54, 1 Decembre 1959. (Discusses problems of relation between the polar motion and the atmospheric circulation and the systematic errors of latitude observations and precision obtainable with instruments of different types.)

Latest Results of Photoelectric Observations of the Time Service at Pulkovo. N. Pavlov. *Bulletin Geodesique* (The Journal of the International Association of Geodesy), Annee 1959, No. 54, 1 Decembre 1959. (Describes observations made in 1955–56 with new type instrument.)

The Influence of the Distant Topography on the Deflection of the Vertical. Bernard Chovitz and Irene Fischer. *Bulletin Geodesique* (The Journal of the International Association of Geodesy), Annee 1959, No. 54, 1 Decembre 1959. (Describes research on the problem by the Army Map Service.

The Hough Ellipsoid or the Figure of the Earth From Geoidal Heights. Irene Fischer. *Bulletin Geodesique* (The Journal of the International Association of Geodesy), Annee 1959, No. 54, 1 Decembre 1959. (Describes formulae for a new figure of the earth named for Floyd W. Hough, formerly chief of the Geodetic Division at the Army Map Service.)

Stellar Triangulation. T. J. Kukkamaki, Finnish Geodetic Institute. *Bulletin Geodesique* (The Journal of the International Association of Geodesy), Annee 1959, No. 54, 1 Decembre 1959. (Describes techniques for long-distance triangulation by photographing flashbulb explosions at various altitudes against the stellar background.)

Computer, Radios Speed Survey. James R. Cass, Jr. *Engineering News-Record,* Vol. 164, No. 7, February 18, 1960. (Describes methods in a survey and soils investigation to determine site conditions for a breakwater in Narragansett Bay.)

International Symposium on Electronic Distance-Measuring Techniques. *Journal of Geophysical Research,* Vol. 65, No. 2, February 1960. (Twenty-six articles and abstracts of articles, edited by C. A. Whitten and Erwin Schmid.)

Education

Meeting the Education Needs of the Next Twenty Years. Glenn B. Warren. *North Carolina Engineer,* Vol. 16, No. 2, January 1960. (Address by the President, American Society of Mechanical Engineers, at the annual meeting, November 30, 1959.)

Colloquium on Survey Education. *The Canadian Surveyor,* Vol. 15, No. 1, January 1960. (Entire issue devoted to the Colloquium held at Ottawa, October 29–30, 1959, and attended by educators and practitioners in the field of surveying and mapping. Proceedings presented in four parts: Introductory; I. The Need for Trained Surveyors; II. Present Status of Education for Surveyors; and III. The Universities' Views on Survey Education.)

Instruments

Instructions for the Use of the Surveying Aneroid and the Paulin Altimeter. H. J. Jenks. *The New Zealand Surveyor,* Vol. 25, No. 6, August 1959. (Description of instruments and procedures, with tables of altitudes and determination of barometric heights.)

Some Thoughts on the Order in Which Theodolite Adjustments May Be Performed. P. C. Miller. *The Australian Surveyor,* Vol. 17, No. 7, September 1959. (Technical discussion with diagrams and formulae.)

A Roller Map Equipment. G. Wikkenhauser. *The Journal of the Institute of Navigation,* Vol. 13, No. 1, January 1960. (Notes on an air navigation aid in its rudimentary form later perfected by introduction of doppler electronic ground speed and direction indicating devices.)

Property Surveys

Town Planning—Mapping the Future. Stuart B. Hart. *Cartography* (Published by the Australian Institute of Cartographers), Vol. 3, No. 1, March 1959. (Traces steps in development of a plan and reviews planning progress in Australia.)

The Land System of Tonga. L. W. Wordsworth. *The New Zealand Surveyor,* Vol. 25, No. 6, August 1959. (Description of the middle-age feudal type land system existing in the remote independent kingdom of Tonga, an island group in the South Pacific.)

Address of the Retiring President, the Association of Newfoundland Land Surveyors. T. H. Winter. *The Newfoundland Surveyor,* Vol. 2, No. 1, January 1960. (Discussion of present situation and action necessary to improve professional status of Newfoundland surveyors.)

Address of Honourable W. J. Keough, Minister of Mines and Resources of Newfoundland. *The Newfoundland Surveyor,* Vol. 2, No. 1, January 1960. (General discussion of relationships of the surveying profession with the provincial government.)

Colombo Plan–North Borneo. Kenneth G. Floyd. *New Zealand Surveyor,* Vol. 23, No. 1,

February 1960. (Report of a land development officer on supervision of surveys for new development in North Borneo.)

THE MINIMUM SIZE OF RESIDENTIAL SECTIONS. Editorial. *New Zealand Surveyor*, Vol. 23, No. 1, February 1960. (Remarks on the necessity for preserving productive lands by limiting size of residential areas.)

Topography

A FLOATING MARK SCANS THE AUSTRALIAN ALPS. W. A. G. Mueller. *The Australian Surveyor*, Vol. 17, No. 7, September 1959. (Details of photogrammetric and ground activities of the Snowy Mountains Authority to provide maps for development of an immense hydroelectric-irrigation project in Australia's highest mountain range.)

SLOPE-ZONE MAPS. O. M. Miller and Charles H. Summerson. *Geographical Review*, Vol. 50, No. 2, April 1960. (Discussion of theory, method of construction, and utilization of slope-zone maps, illustrated by large- and small-scale examples in color.)

MAKING MAPS OF THE MOON. Jim Birchfield. *Sunday Star Magazine*, April 10, 1960. (Illustrated popular description of the Army Map Service project to construct a topographic map of the Moon at the scale of 1:5,000,000.)

BOOKS AND PAMPHLETS

MCKAY'S GUIDE TO ALASKA. Robert G. Hart. *D. McKay Company*, New York, 1959. 330 pages, maps.

GEODESY FOR THE LAYMAN. Air Photographic and Charting Service, Aeronautical Chart and Information Center. Prepared by Geo-Sciences Branch, Chart Research Division. St. Louis, 1959. 77 pages, maps.

THE TRANSITS OF VENUS; A STUDY OF EIGHTEENTH-CENTURY SCIENCE. Harry Woolf. *Princeton University Press*, Princeton, N. J., 1959. 258 pages, map.

THE GEOLOGICAL DEVELOPMENT OF NORTH AMERICA. Philip B. King. *Princeton University Press*, Princeton, N. J., 1959. xvii + 190 pages, maps, diagrams, bibliography.

INTERNATIONAL MAP OF THE WORLD ON THE MILLIONTH SCALE: REPORT FOR 1958. U.N. Secretariat, New York, Department of Economic and Social Affairs, 1959. (UN doc. ST/ECA/SER. D/4.) 103 pages, map.

CALIFORNIA, ROSTER OF CIVIL AND PROFESSIONAL ENGINEERS AND SURVEYORS, 1959–1960. Board of Registration for Civil and Professional Engineers, Dept. of Professional and Vocational Standards. Sacramento, 1959. 387 pages. $1.04.

ELEMENTS OF CARTOGRAPHY. Arthur H. Robinson. 2nd edition. *John Wiley & Sons, Inc.*, New York, January 1960. 343 pages, illustrated. $8.75.

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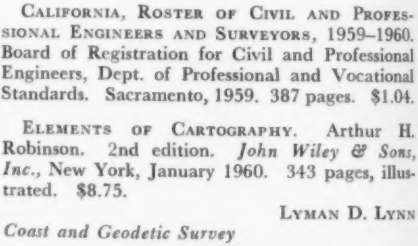

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Distinctive Recent Maps

Three-dimensional plastic relief models are one of the interesting cartographic developments of the past decade. One of the leading producers of such 3-D models is Aero Service Corporation, 210 East Courtland Street, Philadelphia 20, Pa., which in recent years has marketed a number of large wall maps for class room use.

Aero Service recently introduced a series of small plastic models suitable for wall hangings in the den or recreation room. Available are *The United States of America* and *The World*, both of which measure 18½ × 28½ inches. Designated as "True Raised Relief Maps," the models are set within raised plastic frames, colored and grained to simulate wood. Inserted in the back of the map panels are plastic sheets listing and indexing a number of geographical places.

North American Game Fishing Guide locates the most famous fish and fishing places in the United States. The gaily illustrated map was edited by Joe Godfrey and copyrighted, in 1959, by Stephen A. Williams, Jr., 828 Judson Avenue, Evanston, Ill. Fish data are by Herb Chidley and the artist is Henry Sarapata. Measurements are 21½ by 29½ inches.

American Railroads (*Class I*) shows the primary rail transportation network of the United States. It was published by Rand McNally in 1960 for the Association of American Railroads, Washington 6, D. C. The scale is 1:4,000,000 and the measurements are 38 × 52 inches. Inset maps show the States of Alaska and Hawaii. The borders of the sheet are decorated with the colorful trade marks of the major rail carriers.

Navigation and Flood Control Projects of the United States is a 1959 publication of the Corps of Engineers, U. S. Army. It is at the scale of 1:3,750,000 and measures 34 by 52 inches. The map shows harbors, waterways, local protection, reservoirs, levees, and channel improvements, completed and under construction. There are insets of Alaska, Hawaii, the Pacific Ocean, Panama, Puerto Rico, and New York Harbor and vicinity.

A decorative *Map of the Chesapeake Bay*, is a promotional publication of the National Brewing Company, Baltimore, Maryland. The colorful map, prepared by Edwin Tunis, is illustrated with a number of sketches depicting centers of historic or scenic interest. Larger illustrations decorate the right and left borders of the map. The measurements are 22 by 28 inches and the scale is 1:650,000.

The *State of Utah* is a recent addition to the Geological Survey's series of topographic maps of the States. Published at the scale of 1:500,000, the Utah map is available in a planimetric edition, showing water and cultural features, as well as in the contoured topographic edition. The latter shows, in addition to topography, national parks and forests, Indian reservations, county and State boundaries, and cities, towns, and villages.

The Utah map measures 48 by 30 inches. Copies may be ordered from the Geological Survey, Federal Center, Denver, Colorado, *or* Washington 25, D. C. The planimetric map is $1.00 per copy, and the contour and highway edition is $2.00.

The Surveys and Mapping Branch of Canada's Department of Mines and Technical Surveys, [Ottawa] published, in 1959, a new edition of the map of *Canada*. At the scale of 1:4,955,040, the map delimits provinces and territories, locates towns and cities, and traces railway lines and trunk roads. Printed on two sheets, the map measures (if joined) 58 by 58 inches. The listed price is $1.00 per copy, flat, or $1.25 with rods.

Jamaica Geology, at the scale of 1:250,000, was prepared, by the Geological Survey of Jamaica, to accompany the Survey's Bulletin No. 4. In addition to some 22 geological formations, ranging from Cretaceous to Quaternary, the map shows several classes of railroads and roads, administrative boundaries, rivers, canals, swamps, and lighthouses. It is 29 by 41 inches.

The transportation pattern of southern Peru is presented on *Mapa Vial del Sur del Peru*, published by that country's Ministry of Public Works. Shown are international, departmental, and provincial boundaries, railroads, airlines, and several classes of roads, rivers and lakes, and ports classified into several types. The map measures 32 by 23 inches and the scale is 1:2,150,000.

John Bartholomew & Son, Ltd., of Edinburgh, published, in 1960, a new map of *India Pakistan Ceylon*. The scale is 1:4,000,000 and the size is 40 by 30 inches. The map is of the physical-political type with relief shown by the distinctive color gradients which characterize many Bartholomew maps. Roads, railroads, canals, and airports are among the cultural features included. There are inset maps of the Nicobar Islands and the cities of Bombay, Calcutta, Delhi, Karachi, and Madras.

A second, revised, edition of the *Geological Map of the British Territories in Borneo* was published in 1959 by the Geological Survey Department, British Territories in Borneo. It was

prepared in cooperation with Sarawak Shell Oilfields Limited and the Brunei Shell Petroleum Company Limited. Some 19 formations, ranging from pre-Cambrian to Quaternary, are mapped at the scale of 1:1,000,000. The map measures 30 by 43 inches.

Mounting interest in Africa has stirred publishers to get out an assortment of new maps of the continent and its several political and regional entities. Newly established countries of Africa are shown on a 1960 *Afrique* map, published by Cartes Taride, 154 Boulevard St. Germain, Paris 6, France. The scale is 1:8,000,000 and the measurements are 45 by 39 inches. Railroads, major roads, water bodies, and towns and cities are shown, in addition to administrative limits and boundaries.

A three-sheet map of *West Africa,* at the scale of 1:2,000,000, is a recent accession. Compiled and published, in 1957, by the Ghana Survey Department, the map extends to Fort Lamy, and from the Gulf of Guinea north to Tombouctou, beyond 17 degrees north latitude. Roads and railroads are clearly shown and administrative boundaries are delimited.

The Ministere des Travaux Publics et des Transports, of France's Institut Geographique National, is the publisher of a map of *Afrique Equatoriale Française et Cameroun,* at the scale of 1:5,000,000. Administrative boundaries, towns and cities, railroads, roads (classified by type), rivers, lakes, swamps, forest reserves, and spot elevations are among the physical and cultural features mapped.

Afrique Equatoriale Française Esquisse Ethnique Générale shows the areal distibution of some 24 ethnic groups. The map, at the scale of 1:5,000,000, was completed by Marcel Soret, and published in 1957 by Service Geographique de l'Afrique Equatoriale Française et du Cameroun. Measurements are 28 by 19 inches.

Roads, existing and under construction, railroads, and administrative boundaries are included on a recently acquired map entitled *Cameroun Schema Routiere.* The map which is at the scale of 1:2,000,000, is a publication of Service Géographique d'A.E.F.-Cameroun. It is approximately 26 by 16 inches in size.

Sahara an 1:4,000,000, is a 1959 publication of Ivan du Jonchay and Boudeville-Verduron, 7 Rue Thorel, Paris 2, France. Among the many cultural and physical features shown are roads and railroads of various classes, airports and seaplane bases, water bodies, generalized elevation, ergs, oases, petroleum deposits and producing areas, and known deposits and producing areas for some 20 or more minerals. The map measures 31 by 37 inches.

Mean Annual Rainfall Map of East Africa is based on data available to 1955. It was compiled by the Meteorological Department of East Africa High Commission and drawn by the Survey of Kenya. Nine rainfall types are shown, ranging from below ten inches to over 80 inches. The scale is 1:2,000,000 and the map is on two sheets each measuring approximately 23 by 29 inches.

The Survey of Kenya published, in August 1958, a map of *Kenya Colony* [showing] *Air Photographic Coverage to July 1958.* The base map is at the scale of 1:2,000,000. Five types of coverage are indicated, (a) R.A.F. photography 1947–52, (b) R.A.F. photography 1956–58, (c) R.A.F. photography 1955, (d) Contract photography, 1952–58, scales 1:30,000 to 1:40,000, and (e) Contract photography 1954–58, scales 1:10,000 to 1:25,000.

The 1959 edition of the *Caltex Road Map of Kenya, Uganda and Tanganyika* was recently issued. It is at the approximate scale of 1:230,000 and measures 34 by 24 inches. The verso of the map sheet has inset maps of six of the major cities, and of the island of Zanzibar, and an index to the places shown on the road map.

R. L. Esson & Co., Ltd., of Johannesburg, have published several pictorial maps of the southern part of Africa. They include *The Cape of Good Hope, a Guide to its Pleasures Resorts & Historic Places,* and *Natal, a Guide to its Pleasures Resorts & Historic Places.* Both are decorated in the margins and on the face of the map with sketches of scenic and historic places and portraits of early explorers. Each measures approximately 27 by 33 inches. Roads and railroads are clearly shown.

Similar in appearance to the two above-described maps is *The Transvaal, A Guide to its Pleasures and Historic Places,* published by Hortors Limited of Johannesburg. All three maps are available from Map Studio Productions, Ltd., P. O. Box 11204, Johannesburg.

A *General Plan of the Transvaal and O. F. S. Gold and Coalfields* was issued, in December, 1958, by the Central Mining-Rand Mines Group. It measures 29 by 39 inches and is at the scale of 1:380,000. It gives generalized elevations, locates properties of various mining groups, and shows coal and gold outcrops, rivers, roads, and railways.

The Federal Government Printer, Salisbury, Southern Rhodesia, issued recently a *Mean Annual Temperature* [map of] *Rhodesia and Nyasaland.* The map, at the scale of 1:5,000,000, was compiled and published by the Director of Meteorological Service, Salisbury. It is 14 by 12 inches in size.

The transportation net of the Congo and Gabon are mapped on the *Carte des Voies de Communications du Moyen-Congo Gabon.* The map, which is at the scale of 1:1,500,000, was compiled and printed, in 1958, by Service Geo-

graphique de l'Afrique Equatoriale Française-Cameroun. It is available from Institut Geographique National, 136bis Rue de Grenelle, Paris 7, France. Administrative boundaries, railroads, and cities and towns are shown, in addition to several classes of roads.

WALTER W. RISTOW
Library of Congress

Has the Time Come to Adopt the Metric System?

Britain Considers It for Coinage, Could Set Example on Measures

The following editorial from *The Chicago Daily Tribune*, reprinted in the *St. Louis Post-Dispatch*, December 9, 1959, has been again reprinted in SURVEYING AND MAPPING, with the permission of *The Chicago Daily Tribune*, after having been called to our attention by Mr. Henry L. Berg of St. Louis, Missouri. —EDITOR

Recent years have been prosperous in Britain, and one can only guess at how much greater the prosperity would have been if the time and effort of Englishmen had not been wasted adding up awkward columns of pounds, shillings and pence.

To make matters worse, the electronic computers which have proved useful in banks and industries elsewhere can't cope with 12 pence to the shilling and 20 shillings to the pound. As a result, more and more Englishmen, particularly bankers, would like to make the pound worth 100 pence, 10 pence to the shilling.

Britain's currency system is a mixture of Roman values and Teutonic terms. The basic Roman coin was a silver denarius. Twelve of them were worth one gold solidus, and 240 of them weighed one pound, or a libra.

Before the Roman invasion, the English used pennies and shillings, the number of pence to the shilling varying with time and place. When the Romans brought their coins, the denarius was called a penny (but is still abbreviated to d.), and the solidus was called a shilling (but is still identified by the slanted line known as a solidus). When the pound became a unit of currency, it was abbreviated by a sort of L, for Libra.

Other countries which had used the Roman system began to discard it when they adopted the Arabic system of numerals, which is more readily adaptable to arithmetic than the Roman system (have you tried multiplying LXXVI by XIX?).

Mediterranean countries divided the libra (or lira) into 100 parts, and France substituted a decimal system for its livres, sous, and deniers during the revolution, when it sensibly instituted the metric system of weights and measures as well.

Even former British colonies have deserted the ranks. Canada has long had a dollar of 100 cents, and so now do the British West Indies, Hong Kong, and Malaya. British East Africa uses a shilling of 100 cents. Cyprus has a pound of 1,000 mills. Ceylon has a rupee of 100 cents, and India recently adopted a rupee of 100 "new pice."

But England and few loyal countries have stuck to the old system and have rationalized their affection for it by pointing out that it permits division into 2, 3, 4, 6, or 12 parts, and is thus better suited than the decimal system from pricing, purchasing, and relating annual and monthly figures.

This may be true, but there is no point fighting the fact that man was born with 10 fingers and has become attached to the decimal system of numbers.

If the British decide that their currency is, indeed, outdated, they will be wiser to change it than to wait for the world to adopt a duodecimal system of numbers, whatever its attractions may be.

At the same time the United States is in no position to carp. If Britain gets up the momentum to throw out its hallowed coinage system, might it not also junk its pounds, ounces, gallons, quarts, acres, and miles, and substitute the metric system all around?

We would then be the only stick-in-the-mud using our present cumbersome system of weights and measures.

We are free to shift to the metric system whenever we like, because it was made legal in this country by Congress in 1866.

The Surveyor and the Law

Responsibility of the Surveyor to the Land Owner*

To recapitulate, in dealing with the responsibility of the surveyor to the land owner we must not overlook the statutory provisions licensing the surveyor and N.J.S.A. 45:8–38, which provides that the examining board shall have the power to revoke the certificate of license of any professional engineer or land surveyor who is found guilty of gross negligence, incompetence, or misconduct in the practice of professional engineering or land surveying. A complaint may be filed with the Board by any person and the Board, if it deems that the charges are of a serious nature, may set a hearing, at which time the surveyor or engineer shall have the right to be heard and to cross examine witnesses. If the license is revoked the Board has the power to reissue the license.

Secondly, it must be observed that the surveyor in most actions with the owner is under a contractual obligation to measure with the bargain he entered into with the particular owner. These contracts are of various types and come about in various manners and fall in no one category. I have discussed the elements of a "simple contract," an "express contract," an "implied contract," an "informal contract," and a "formal contract." You will recall that if a contract is found to exist by a court in a breach on the part of the surveyor, the owner is entitled to damages, the measure of which is the value of the agreed performance or the cost of completing the contract. The rule is, however, that the damages must flow as a consequence of the breach in the usual course of events. It must be proximate and natural. They must be direct and certain of amount and in most cases they shall be fixed by a jury.

It is well to be aware of the third party beneficiary doctrine which provides that even though a surveyor may enter into a contract with an attorney the contract can be construed as being for the benefit of the land owner and the land owner may, in the event of a breach, sue for damages and directly join the surveyor. I had suggested that a modern land surveying firm should have its own standard form contract to use for the majority of transactions involving professional services of the surveyor.

The last category of liability is one which arises under general tort law. I have alluded to law of trespass and assault but confined my remarks mainly to the doctrine of negligence and the rule found in Clark on Surveying and Boundaries, Section 580, "A surveyor employed by private parties—must exercise due care which a skilled surveyor of ordinary prudence would exercise under similar circumstances—upon failure to do so he will be liable in damages to the extent of the injury to those employing him—either while acting as a public official or in a private capacity." I discussed the leading cases in the Country and the cases found in New Jersey. It is to be remembered that even though a contract may be entered into for $25 for a survey that the ultimate damages found against a surveyor for negligence could run into untold numbers of dollars in the event negligence is found to exist on the part of the surveyor. Damages must be those which are proximate and are causally related by the negligent act in question. It is well to note that it is the professional duty of an attorney to search a title and to report all observable defects, deficiencies, and imperfections of a title. This is not and never was a professional duty of the surveyor and if an owner asks for this service it should be done by a competent attorney or a title abstractor, and the surveyor must not absorb this in his cost for a survey. If liability does exist upon a surveyor for negligence the statute of limitations runs from the time of the breach of the duty and not from the time of the discovery of the error. The rule to observe is that a surveyor may sue only for the value of services for which he is duly licensed under the State Act or a contract shall be held to be null and void by a court and shall not be enforced against the land owner.

In closing it is advisable to consult a competent insurance broker with regard to insurance

* Author's summary of a paper presented at the 20th Annual Conference of the Land Surveyors Division of the New Jersey Society of Professional Engineers by Harold Valentine, a title attorney in New Jersey.

coverage for professional errors and omissions. It is well also wherever complaints and important contracts are involved to obtain the advice of a competent attorney.

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"Engineer"

Engineers Joint Council has embarked on a new publication program designed to inform individual members of its constituent societies as to the plans and actions of the Council. *Engineer*, Vol. 1, No. 1, Spring 1960, is the first issue of a quarterly publication which will go to each individual member of the 21 engineering societies which make up the Council. The first issue of *Engineer* is 4 pages, 11 × 15 inches, printed on newsprint, and is obviously the "newspaper" it was designed to be. There is no commercial advertising in the first issue.

Repairs Planned for Mason-Dixon Line

Everybody talks about it, but few know just where the Mason-Dixon Line runs, and fewer still know how it came about.

In popular American parlance, the Mason-Dixon boundary divides North from South—an assumption based largely on the mistaken belief that during the Civil War it separated the Confederate States from the Union.

In fact, the line was drawn to end an early colonial land dispute. It extends, from east to west, between Pennsylvania and Maryland, with a shorter branch reaching southward between Maryland and Delaware. All three States were on the Union side.

The old border is again in the news because of plans to restore its markers for a 200th-anniversary celebration in 1963.

The Mason-Dixon Line was named for two English surveyors, Charles Mason and Jeremiah Dixon. Skilled mathematicians and astronomers, they were invited to the American Colonies in 1763 to mark the boundary finally agreed upon by long-feuding proprietors and heirs of Maryland and Pennsylvania land grants.

The controversy began in the mid-1600's, when the Dutch Government and the Calverts of Maryland both claimed the big peninsula between the Delaware and Chesapeake Bays.

After the Dutch were pushed out of the region, William Penn inherited the dispute with his royal charter for Pennsylvania and adjoining land. The bickering over conflicting interpretations of the Penn and Calvert charters continued for generations, and the case eventually came before England's Court of Chancery.

The Court gave a compromise decision in 1750. It specified that the delineation of the Pennsylvania-Maryland border should begin at a certain point southwest of Philadelphia and west of New Castle.

From that point the main boundary was to be drawn westward. A second line would run southward into the heart of the peninsula and meet a third reaching eastward to the Atlantic coast. The proposed line gave Maryland the bulk of the peninsula. Pennsylvania retained the northeast portion that later attained independence as Delaware State.

The disputants signed the agreement in 1760. Local surveyors then began work, but made so little progress that Mason and Dixon were called in.

Curiously, little is known of the two men who set up America's most famous boundary. Charles Mason was assistant astronomer at England's Greenwich Observatory. With Dixon, whose background is obscure, he had been sent abroad in 1761 to observe a transit of Venus.

The survey of the Pennsylvania-Maryland borders took four years. After checking and correcting the peninsula lines, Mason and Dixon took the westward trail in 1765 with a large party of assistant surveyors, axmen, and guides. They covered some 230 miles of wild and beautiful country before hostile Indians forced them back.

But the job was already completed. The accuracy of their measurements has been proven by modern surveyors, who found a difference in latitude of only 2.3 seconds (232 feet) from the Mason-Dixon figure.

A new survey of the three States' boundaries was made in 1960. Most of the original stone markers were in place. Many had deteriorated, however, especially the original five-mile "crown stones" carved in England with Penn and Calvert arms on either side.

Beside repairing, strengthening, and resetting the worn and broken markers, mile by mile, officials of the restoration program will have to replace those lost, removed, or covered by dam waters, railways, and roads.

National Geographic Society

Books in Review

ISAMBARD KINGDOM BRUNEL, a Biography. L. T. C. Holt. *St. Martin's Press,* New York, 1959. xiv + 345 pages, 30 illustrations. $6.00.

The life of this great 19th century British engineer is a forceful demonstration of perseverance, tenacity, and ingenuity, contributing immeasurably to the initial developments of the industrial revolution. The son of a great engineer, Marc Brunel, Isambard followed his illustrious father's footsteps through many dramatic episodes freely sprinkled with tragedy. These two great engineers, small in physical stature but large in accomplishment, demonstrated finely tempered, resilient qualities, flexing easily under misfortune but never yielding in objective. Beginning with bridge and tunnel building at an early age, Isambard Brunel became associated with the construction of railway systems in Great Britain, actually building more than 1,000 miles of track. His capability as a surveyor as well as a structural and designing engineer was demonstrated by the surveys which he made personally of the rights-of-way for the first great railway lines of the British Isles. His father completed the Thames River tunnel as his life's masterpiece, while the younger Brunel became intensely involved in shipbuilding. He turned from railway engineering to ship design and construction as a result of the wild commercial opportunism and speculation which emanated from the success of the first railroads. His first great ships, the *Great Western* and the *Great Britain,* set the pattern for achievement in this field. Both were the largest ships afloat of their day and were the first truly transatlantic steamships. The *Great Britain* was the first screw ship and the first iron ship to cross the ocean. His last great achievement was the building of the *Great Eastern,* a project marked by tragedy and adversity that finally wrecked his health. The modern engineer can benefit by becoming familiar with the trials and challenges accepted and overcome by one of the greatest engineers of his time. The book is a memorable portrait of a most extraordinary character who contributed greatly to engineering knowledge at a momentous period in English history. Brunel was truly among the greatest of the giant personalities who dominated the 19th century.

ALBERT A. STANLEY

ANGLO-AMERICA, A REGIONAL GEOGRAPHY. Earl B. Shaw. *John Wiley & Sons, Inc.,* New York, 1959, 480 pages, $6.00.

This recent addition to the expanding body of literature on regional geography effects two beneficial ends; first, it presents a thorough and up-to-date panorama of the geography of Anglo-America; and, secondly, it sponsors an innovation in the regional method of treatment in geography—that of placing emphasis on regional boundaries as opposed to core areas.

The presentation of the factual information in the book follows a more-or-less traditional outline. Thirteen regions, based largely on land-use as related to physical environment, are used as the vehicle to expose a vast amount of pertinent information about the land. The regions, such as the Middle Atlantic Coastal Plain, the Great Plains, etc., have been used before and represent a standard pattern of organization. Inasmuch as Greenland is included, the book transcends beyond Anglo-America, but this actually adds to the usefulness of the work.

The author's treatment of regional boundaries may well be considered an innovation. Many regional works emphasize only the core of the regions concerned. This particular work endeavors to treat the periphery of the regions as well. Recognizing that regional boundaries are changing and transitional, the author nevertheless delineates the boundaries of many of these regions. Not only is this useful to the student, for whom the book is written, but it obviously has a beneficial cartographic implication. More accurate regional boundaries can now be placed on maps because the author has spelled them out better. The more this is done on such a scale, the more the products of the cartographer's art will, in this respect, be improved.

A. J. WRAIGHT

AERIAL PHOTOGRAPHIC INTERPRETATION. Donald R. Lueder. *McGraw-Hill Book Company,* 1959, 462 pages, $17.50.

This new work on the subject of photographic interpretation is extremely comprehensive and deserves its place in the Civil Engineering series. Presented in three parts; Principles and Theories of Photo Interpretation, A Lexicon of Geomorphology and Landforms as Seen by the Aerial Photograph, and Applications of Aerial-photographic Techniques to the Various Fields of Earth Science; the book gives complete coverage.

The first part deals with the general geology factors or origins, surface drainage patterns, erosion features, gray tones, and elements such as vegetation and culture. Part two presents fluvial, marine, lacustrine, glacial, and aeolian landforms and rock types. Part three follows the applications to engineering, geology, geophysics, agriculture, forestry, botany and ecology. Only one chapter is devoted to the combined fields of urban, regional, and military interpretation.

Practical examples are developed and guidance is given to any who wish to make use of the included subjects. Recent advances and newer concepts are presented in the text or in the appendices.

The author has made excellent use of a wide selection of aerial photography. Thorough referencing aids the reader in obtaining original and additional material on nearly every subject covered. This book is highly recommended.

CHARLES E. COOK

SURVEYOR OF THE SEA. Bern Anderson. *University of Washington Press,* Seattle, 1960. xii + 274 pages, 10 illustrations, and 5 maps. $6.75.

Captain George Vancouver's voyage of discovery, 1790–95, is effectively summarized in this significant new book by a retired Rear Admiral of the U. S. Navy. Vancouver's brief lifetime, extending from 1757 to 1798, included some of the greatest events in the development of the British empire. This excellent account of the life and voyages of Vancouver reports on significant highlights of history as they affected his place in history. George Davidson and William H. Dall, early Coast and Geodetic Survey explorers of the Pacific Coast and Alaska, attested to the excellence of Vancouver's work. This aspect of the period of exploration is now brought into modern focus, revealing Vancouver's boundless energy, strict discipline, and meticulous attention to detail, enabling him to perform a surveying feat that set standards for accuracy and precision of the late 18th century. The book reveals the early apprenticeship of Vancouver at the age of fourteen aboard Captain Cook's *Resolution.* His historic voyage with his ship *Discovery* and the armed tender *Chatham* was carried out at the direction of the British Admiralty in an attempt to discover a northwest passage. Perhaps he was prouder of proving the absence of a northwest passage within the limits of his survey than he was of the map that resulted from his search. His accomplishments were tremendous, however, as set forth in his historic Journal published in 1798 in three volumes of six books each, with a separate atlas. This voluminous record and many unpublished manuscript sources, as well as a comprehensive list of published sources and references, provided the source material for this important new book. Vancouver's contribution to history was political as well as geographical, as the book sets forth. His negotiations for the British government of Spanish claims in northwest America, and his negotiations with the king of Hawaii had all the marks of an able diplomat. George Vancouver's reputation as a surveyor, mapmaker, explorer, navigator, and geographer is greatly enhanced and better understood by having this new historic account. The biography is a modern assessment of the character and personality of Vancouver, with an American naval officer's tribute to a reserved and intent British naval officer of former times.

ALBERT A. STANLEY

THE SEA OFF SOUTHERN CALIFORNIA. K. O. Emory. *John Wiley & Sons, Inc.,* New York, 1960. xi + 366 pages. $12.50.

The integration of basic scientific knowledge relating to nearly all facets of the marine environment into a single volume of 366 pages seems like an improbable accomplishment. Yet this has now been done for the Southern California area, which has been subjected to more scientific exploration and mapping over a greater period of time than any comparable region. The author has had a significant role in these explorations and in the ensuing studies of collected data.

The subject matter begins with reference to man's presence on Santa Rosa Island nearly 30,000 years ago; relates the sequence of early explorations of the region; describes and illustrates the physiography and geological structure of the mainland coast, offlying islands, and the sea floor; discusses marine sediments, particularly as they relate to the origin and accumulation of petroleum; discusses the sea, its physical characteristics and the various types of cur-

rents, waves, and plant and animal life; and concludes with a discussion of the various economic aspects of the marine environment, including a summarization on legal boundaries and law of the sea. The author has performed a commendable service in bringing together an assemblage of so much related information about a most interesting geographical and economically important region. He has included a list of approximately 850 references, a worthy contribution to scientific literature.

G. F. JORDAN

ELEMENTS OF CARTOGRAPHY (Second Edition). Arthur H. Robinson. *John Wiley & Sons, Inc.*, New York, 1960. viii + 344 pages, illustrated. $8.75.

Professional cartographers, cartographic aids, geographers, educators, and students may find in this latest addition to important cartographic literature the detailed and progressive guidelines long needed to further the work of modern cartography. This new edition presents basic cartographic data essential in producing an accurate, attractive, and comprehensive map. Recent major developments that have occurred in cartographic techniques and applications created a compelling need for a new edition of the book, first published in 1953. The extensively modernized text, supplemented by more than 70 new illustrations, provides up-to-date and intensive treatment of pertinent phases of cartography such as map projection, symbolization, map design, and map reproduction processes. The student of cartography, his instructor, junior employees in cartographic fields, and those in supervisory and training capacities require a manual suitable for operational application as well as an instructional medium. These requirements are provided for in the new book. It is a scholarly treatise in the field of theoretical cartography and at the same time a practical medium for those requiring an everyday guide to cartographic techniques and procedures. The format is especially effective, including the system of numbering sections and illustrations, and the titling and organization of chapters. This type of format is finding wide use in a variety of technical manuals.

ALBERT A. STANLEY

BOOK NOTES

In this section of the "Books in Review" department, we propose to include brief notices of books and other publications, which are not complete enough to be considered as reviews but which are in greater detail than is usually given concerning publications listed in the "Books and Pamphlets" section of the "Surveying and Mapping Literature" department.

EDITOR

REPORT ON THE EIGHTH ANNUAL TEXAS SURVEYORS ASSOCIATION SHORT COURSE. Paper cover, 6×9, 106 pages, no price stated.

This report of the Eighth Annual Texas Surveyors Association Short Course; sponsored by Bill Allcorn, Commissioner of the General Land Office (Texas), the Texas Surveyors Association, the University of Texas, the Agricultural and Mechanical College of Texas, and the Board of Examiners of Land Surveyors; contains the published papers for the meetings which were held in Austin, Texas, October 5–7, 1959. The following papers are included in the publication:

"Enforcement Phases of House Bill 142," by Fred Williamson, Member of the Texas State Board of Registration for Public Surveyors,

"Surveying for Proposed Lake Locations," by Colonel Walter Wells, Corps of Engineers, Fort Worth District,

"Short Base Traverse," by Samuel C. Richardson, San Antonio Field Office, Army Map Service,

"Photogrammetry—A Line on the Level," by Jack Ammann, Jack Ammann Photogrammetric Engineers,

"What the Attorney Expects of the Surveyor," by Joyce Cox, President, Houston Bar Association,

"University Curriculum With a Major in Surveying," by Dr. F. M. Tiller, Dean, Cullen College of Engineering, University of Houston,

"Commentary on Ordinances Related to Spanish and Mexican Grants," by M. Lozano, Carnes & Lozano, Registered Public Surveyors,

"Financial Accounting and Tax Considerations of Surveying Organizations," by Charles W. Tindall, Certified Public Accountant, Price waterhouse & Company,

"Problems of Surveyor and Lawyer in Boundary Litigation," by Fred A. Lange, Attorney, Gulf Oil Corporation, and

"Insurance and Horse Sense," by Jack Flatt,

State Agent, American Fire and Casualty Co.

SAN FRANCISCO EARTHQUAKES OF MARCH 1957. Gordon B. Oakeshott, Editor. Special Report 57, California Division of Mines, Ferry Bldg., San Francisco, Calif. 8⅜ × 11, paper cover, 128 pages, illustrated. $1.25.

This publication includes the work of eleven contributing authors reporting on the findings of nine organizations cooperating in the investigation of the most damaging earthquake in the San Francisco area since the great earthquake of April 18, 1906.

WIRE DRAG MANUAL. Kenneth S. Ulm. Coast and Geodetic Survey, Publication 20-1, 6×9, paper cover, v + 103 pages, illustrated. Available from Superintendent of Documents, Government Printing Office, Washington 25, D. C. at 35 cents per copy.

The following, quoted from the Preface, briefly describes this publication:

"The Wire Drag Manual has been prepared and is issued for the purpose of giving the general requirements of the Coast and Geodetic Survey for the execution of wire-drag surveys. In it, modern methods and equipment used in wire-drag work are described. It is one of a series of manuals covering the various survey operations of the Survey.

"The progress and development of instruments, equipment, and methods in the past 34 years necessitated the revision of Special Publication No. 118, "Construction and Operation of the Wire Drag and Sweep," published in 1925. The changes introduced by the advent of electronic control, improved means of communications, the use of more efficient equipment, and improved drafting techniques, have caused modifications and improvements in field and office operations, which were not considered in the older manual."

PROCEEDINGS OF CONFERENCES ON LAND SURVEYING (1958 AND 1959). Engineering Bulletin of Purdue University, Engineering Extension Series, March 1960, Series No. 101, 6×9, paper cover, 164 pages, illustrated, $1.00.

Contains the following papers from the 1958 and 1959 Conferences on Land Surveying:

"Surveying and Mapping for Transmission Lines" by Owen C. Smith.

"Surveying and Mapping in Strip Mining" by Ronald E. Samples.

"What We Expect from the Land Surveyor" by Raymond E. Sweat.

"A Code of Ethics for Land Surveyors" by John H. Matthews.

"Restoration of Lost or Obliterated Corners" by Lloyd H. Kemmer, and Clark L. Gumm.

"Pages from the Notebook of a Land Surveyor" by Arthur D. Kidder.

"The Planning and Design of Subdivisions" by Charles D. Cashman.

"Modern Subdivision Control Ordinances" by Lawrence V. Sheridan.

"Control of Flooding in Suburban Developments" by M. Clifford Boyer.

"Use of Electronic Computation in Subdivision Design" by Howard Jacoby.

"Michigan's Subdivision Plat Law" by John J. McMahon.

"The Importance of Topography and Drainage in Subdivision Planning" by John H. Matthews.

"Possible Revision of the Duties of the Office of the County Surveyor" by Nelson L. Prall.

"Problems in the Private Practice of Land Surveying" by Harold E. Smith and Henry H. Vogler.

"Wisconsin's Apprenticeship Training for Land Surveyors" by Leonard F. Hillis.

"Bibliography of Subdivision Planning" by John H. Matthews.

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Isogonic Chart

The 1960 edition of Isogonic Chart No. 3077 of the United States, with the States of Alaska and Hawaii included for the first time, is now available from sales agents, District Offices, and the Washington Office of the Coast and Geodetic Survey for 50 cents a copy. Sheet size is 31 × 46 inches.

The chart is issued in a new format with the 48 states shown on one side of a single sheet, printed back-to-back with the new States of Alaska and Hawaii. These charts show the distribution of magnetic declination or variation of the compass and rates of annual change for the entire nation. The iso-lines connect points of equal magnetic declination and of equal annual-change rates. The 1960 edition of Chart No. 3077 supersedes the preceding edition published in 1955. Chart 3069b, Isogonic Chart of Alaska for 1955, is obsolete and will not be reissued.

Abstracts of Articles on Geodesy and Related Fields

The following excerpts from *Abstracts of Articles on Geodesy and Related Fields,* Vol. 5, No. 1, January 1960, are selected for reprinting in SURVEYING AND MAPPING as being of possible interest to a considerable number of our readers. The selection has been somewhat arbitrary, and only those abstracts believed to be of quite general interest have been included. —EDITOR

596 *Ideas on a Derivation, Free of Hypotheses, of the Mean Earth Ellipsoid and the Undulations of the Geoid* (Gedanken zu einer hypothesenfreien Ableitung des mittleren Erdellipsoides und der Undulationen des Geoides). K. Ledersteger

The determination, free of hypotheses, of the problem of the figure of the earth, discussed here, shows that the two important tasks—i.e., determination of the physically uniquely defined mean earth ellipsoid and determination of the undulations of the actual geoid with regard to the earth ellipsoid—can be solved only alternately in successive approximations. The sequence of operations is as follows:

a. Selection of one of the arc measurement ellipsoids, preferably the international ellipsoid, as first approximation for the earth ellipsoid.

b. The true free-air reduction furnishes, from the observations, the distribution of gravity on the free-air geoid simultaneously with its heights f above the actual geoid.

c. Development of these gravity values according to spherical harmonics permits computation of the gravity disturbances, the flattening of the corresponding level spheroid and the parameter δ which, again, furnishes the distance of the level spheroid from the ellipsoid of rotation with the same axis.

d. The heights N of the free-air geoid above its level spheroid are obtained by means of the Stokes integral.

e. The flattening of the earth ellipsoid is then determined gravimetrically, according to the projective principle, by means of the gravimetric heights whereby the definitive undulations of the actual geoid and the exact gravity formula for the mean earth ellipsoid are obtained simultaneously.

f. Various continental nets can now be projected onto a reference ellipsoid with the axis of the International ellipsoid and the flattening of the earth ellipsoid according to Pizzetti's procedures, and the relative deflection of the vertical in the fundamental point can be set here as equal to zero.

g. The equation for the absolute or the astronomic-gravimetric deflections of the vertical then furnishes the axis of the earth ellipsoid as well as the true-to-nature net on the basis of projective equations for the deflection of the vertical by Vening-Meinesz. If the method is applied to nets on two continents separated by the ocean, the absolute reciprocal position is obtained to an accuracy considerably better than that of all other methods.

It is evident that the two problems are essentially reversed: the heights of the actual geoid must be known with regard to an ellipsoid which is rigorously defined physically before the flattening of the earth ellipsoid can be computed and, in general, the undulations of the actual geoid must be known with regard to the earth ellipsoid before the latter's axis can be determined.

BULLETIN GEODESIQUE (German) AMS-GL-B920.7000, New Series No. 50 (1958)-ms

597 *The Question of the Free-air Geoid and the True Free-air Reduction* (Zur Frage des Freiluftgeoides und der wahren Freiluftreduktion). K. Ledersteger.

Following a first paper, entitled "A Modification of the Free-air Reduction," by the same author, the subject problem is discussed with an emphasis on the hypothetical assumptions concerning the unknown irregularities of mass in the earth's crust and the estimate of their possible error effect.

The improved solution varies from the previous by the use of the empirically determinable potential difference ΔW_P and the more exact reasons for the use of the free-air gradient $\gamma_n = +[0.30855 + 0.00022 \cos 2\varphi - 0.000072\ h_{km}]$ mgal/m in going down. The new representation also shows more clearly the still-present

hypothetical elements. They are as follows:

1. The irregularities of mass in the earth's crust in the layer between the geoid and the level of the observation station P are neglected, likewise the disturbing effect of the topography of the sea bottom. Therefore, the perturbation v_g in the vertical gradient remains only limited to the effect of the topography of the continental masses.

2. The height f is affected by the error of the orthometric height h of the station. This error, however, can only reach a few decimeters.

3. The height f suffers a further falsification by the suppression of the integral $\int_h^H TUdz = T_0$ (H-h).

But, even if this error should amount to 1 meter, this would only result in an error of 0.3 mgal in g_F (gravity on the free-air geoid).

4. The topographic correction T_P must be computed with the mean crustal density of 2.67 just as the height above sea-level h. On the other hand, the gravity values g_F on the free-air geoid are completely independent of the error in the orthometric height above sea level and of the assumed density of the Bouguer plate.

The improved free-air reduction may be far superior to the isostatic method of reduction in simplicity of computation and in reliability of the reduced gravity values and the indirect effect. It has the additional great advantage of complete independence of definite mass displacements and strict preservation of the outer space potential. The free-air geoid is an artificial geoid for which the remainder function does not vanish, but whose level spheroid belongs to the series of "neighboring geoids," which is characterized by the constancy of the velocity of rotation and the potential value of the actual geoid.

Oesterreichische Zeitschrift Fuer Vermessungswesen (German) AMS-GL-B661.-7000 Vol. 47 No. 2 (1959)-mc

601 *Investigation of the Vertical Motion of the Earth's Crust in Czechoslovakia.* (*Výzkum svislých pohybů zemské kůry v Československé republice*). Bedřich Kruis

After a brief description of the Austro-Hungarian, the first and the second Czechoslovak leveling nets and their adjustments, a detailed study is presented concerning the influence of the vertical motion of the Earth's crust on the accuracy of a leveling net of high precision.

The procedure of connecting the leveling lines between Czechoslovakia, Hungary, and USSR is explained. There were four first-order bench marks (Lišov, Strečno, Nadap, and Trebušany) which were used for the leveling connections between the three countries.

A detailed description is presented concerning the Lišov station and the influence of the vertical motion of the Earth's crust as well as the problem of stabilization of that station.

Geodetický a Kartografický Obzor (Czech) AMS-GL-B662.7200, No. 8 (1959)-ma

607 *Time and Latitude Determination with Danjon's Impersonal Prismatic Astrolabe.* (Zeit- und Breitenbestimmung mit dem unpersoenlichen Prismenastrolab von Danjon). E. Buschmann

A. Danjon equipped the prismatic astrolabe, designed by Claude and Driencourt, with an impersonal micrometer and made other structural improvements. The new instrument has been used by the Potsdam Geodetic Institute since 1957 for its time and azimuth determinations.

The construction of the instrument is discussed in great detail. The observation method and evaluation of the observations are fully discussed. The slight difference between the internal and external mean errors of the latitude determinations is worthy of note and indicates that the observations are free from noticeable systematic errors.

While the results of observations for only one year are inconclusive, there is every indication that the new instrument increases the accuracy of the observations and will be of great help to all organizations engaged in this work.

Vermessungstechnik (German) AMS-GL-B664.7350, Vol. 7, No. 6 (1959)-ms

608 *Further Development of the Gauss Mean Latitude Formulae.* (Weiterentwicklung der Gauss'schen Mittelbreitenformeln). Karl Hubeny

The Gaus mean latitude formulae extended to the seventh order, usable for inverse computation involving rather long geodesics, say 2000 km, are presented and the solution with an accuracy of the order of one millimeter has been proved.

These formulae are derived from the inversion of the Legendre power series for forward computation.

A comparison between the numerical evaluation of the extended Gauss mean latitude formulae as developed in this paper and the "great spheroidal standard example" from Jordan's *Handbuch der Vermessungskunde* resulted in

an agreement within the order of one millimeter.

The range of applicability of the above mean latitude formulae for the solution of inverse computation is illustrated by the following tabulation:

$\varphi_m = 50°$

Order of neglected terms:

Application of the mean latitude formulae up to and including

	0.01m maximum coordinate differences $\Delta\varphi = \Delta l$	0.001 m	0.0001 m
1st order	0°01′	0°00′25″	0°00′12″
3rd order	2°40′	1°40′	1°10′
5th order	8°50′	6°30′	5°00′
7th order	16°00′	14°00′	12°00′

ZEITSCHRIFT FUER VERMESSUNGKUNDE (German) AMS-GL-B644.7001 Vol. 84, No. 5 (1959)-mc

609 *The Mean Earth Ellipsoid* (Ueber das mittlere Erdellipsoid). K. Arnold

As is well known, normal gravity enters into Stokes' formula for the computation of the undulations of the geoid by determining gravity anomalies by means of the normal gravity. The author shows the influence of a change in the "flattening of gravity" in the formula for the normal gravity on the major axis of the spheroidal level surface, the undulations of the geoid, and the absolute deflections of the vertical. A procedure is given for correcting the dimensions of the mean earth ellipsoid.

MITTEILUNGEN DES GEODAETISCHEN INSTITUTS POTSDAM (German) AMS-GL-B664.2350, No. 706 (1959)-ms

613 *Systematic Errors in Leveling* (Systematische Fehler in Nivellement). M. Drodofsky

One of the most peculiar qualities of systematic errors in leveling is their tendency to become irregular errors with increasing length of such leveling. The assumption is justified, therefore, that in reality, accidental errors are often involved, which add up in an "accidental" manner over fairly short distances and thus simulate systematic errors.

This assumption can be checked easily by computing to centimeters, levelings measured and computed to millimeters, and to millimeters, precise leveling measured and computed to 0.1 mm. These computations and their results are illustrated by four graphs.

On the basis of a theoretical leveling, the author then investigates the possibility of determining at what distance of a leveling a seemingly systematic error becomes accidental, and how to decide whether a "systematic" error is really systematic. This can be done by mathematically computing the mean error to be expected from collimating errors, estimating errors, errors in rounding off, rod errors, instrumental errors, etc. If the observed error clearly is larger that twice this computed mean error (both referred to 1 km. of leveling, forward only), there exists, according to the example of the theoretical leveling, a certain probability that this mean error is really systematic. This probability can become certainty, if the systematic error is observed in several leveling operations and shows a dispersion corresponding to the mean error to be expected.

The author states, in conclusion, that no attempt is made at discrediting the existence of systematic errors, but that rigorous demands must be made on the proof of such errors.

ZEITSCHRIFT FUER VERMESSUNGSWESEN (German) AMS-GL-B664.7001 Vol. 84, No. 7 (1959)-ms

624 *The computation of Nets with Excessive Determinations Obtained from Linear Measurements* (Sur le calcul de réseaux hyperdéterminés à measures linéaires). A. Ansermet

The nets obtained by linear measurements, as in triangulation, may take various shapes. For certain nets with large loops, the extent of the area requires computation on a surface. Schemes located in a plane are the limited object of this discussion. The most simple scheme consists of a simple, open, unconnected chain with triangular loops. In the systems with large loops, the inverse of the weight takes the form of a binomial, only one of whose terms depends on the length to measured. The structure of the net is also important. If the equality, or near-equality, of the side lengths can be achieved, it will also apply to the respective weights.

In certain respects, connecting elements are of greater necessity for nets established by distance measurements than in triangulation. In determining the unknown coordinates, the existence of tie points helps the computer in the choice he has to make. Already, during the adjustment, such points permit disclosure of possible scale errors. Concerning connecting azimuths, there are two possibilities: (1) the observed azimuths are considered as free of er-

rors, and (2) the azimuths are included in the adjustment. In the first case, the weight assigned to the azimuths is infinitely great. In the second, it is sometimes difficult to assign a weight which is in good correlation with the weight of linear measurements. In each case, it must be established which of these two alternatives must be considered. Generally speaking, since it is not possible to see from one station to the other, a complication arises in the nets with large loops. Therefore, recourse is taken to an auxiliary side and auxiliary azimuth.

A provisional value for a geometrical figure with rigorously equilateral triangles is expressed

$$L_0 = L_1 + f_1 = L_2 + f_2 = \ldots = L_n + f_n$$

By a slight deformation of this figure, an adjusted scheme is obtained with the sides

$$L_1 + v_1, L_2 + v_2 \ldots L_n + v_n$$

The sides have undergone increases:

$$(v_1 - f_1), (v_2 - f_2) \ldots (v_n - f_n).$$

If there is a net with large loops, the binomials $(v_1 + t), (v_2 + t) \ldots (v_n + t)$ must be substituted for $v_1, v_2 \ldots v_n$, where t denotes a correction independent of the measured length. The computation of the deformation is easy. For the elimination of t, proper formulae are presented.

The simplest method of checking the weights is to use base lines which are accurately known. For various hypotheses with respect to the weights, a different system of vales v_1, v_2, $v_3 \ldots v_n$ is obtained. In order to make a suitable selection, a satisfactory relation between these values is established by means of a projective correspondence. In the computation of the mean-square error with respect to the unit of weight the selection is important.

An illustrative example is also shown.

Schweizerische Zeitschrift fuer Vermessung, Kulturtechnik und Photogrammetrie (French) AMS-GL-B644.7200, Vol. 57, No. 6 (1959)-ma/ms

629 *Evaluation of the United States Topographic Maps by the Soviet Geographers* (Geographicheskaya otsenka topograficheskikh kart SSHA). N. F. Leont'ev, Z. I. Martynova, and L. R. Serebryannyy

After a brief historic review of the development of mapping in the U. S., topographic maps were superficially analyzed. It is believed that these maps are not of a high quality. The inadequacy of topographic elements is especially criticized, as well as the lack of coordination between various mapping agencies in the U. S. However, it was reported, the recent mapping-operations of the U. S. Army, Army Map Service, considerably improved the mapping of the U. S. as far as topographic maps are concerned.

Izvestiya Akademii Nauk SSSR, Seriya Geograficheskaya (Russian) AMS-G23 A34, No. 6 (1958)-ma

631 *Comparison Between Optical Distance Measuring Instruments and Radio Distance Measuring Instruments* (K voprosu o sravnitel'noy otsenke svetodal'nomernoy i radiodal'nomernoy apparatury). V. P. Vasil'ev

A brief description of the Tellurometer is presented. Then the question is answered as to whether the radio distance meter will eliminate the use of the optical distance meter.

A comparison between the Geodimeter and the Tellurometer is presented. Since the mean error of distance measurement with the Geodimeter is

$$[m_L = \pm(1 \cdot 10^{-6}L + 0.02 \text{ m.}]$$

and with the Tellurometer

$$[m_L = \pm(3 \cdot 10^{-6}L + 0.05 \text{ m.}],$$

it was concluded that the accuracy of the Geodimeter is three times greater. It was also stated that future improvements of both instruments will hardly reduce this difference.

Geodetic operations requiring high accuracy will be carried out by optical distance meters, while radio distance meters will be used for surveys of lower accuracy.

Izvestiya Vysshikh Uchebnykh Zavedeniy, Geodeziya i Aerofotos'yemka (Russian) AMS-GL-B675.2215, No. 1 (1959)-ma

Pascagoula Harbor Chart

Designed and constructed to provide more adequate coverage for maritime operations serving the Pascagoula area, the new Chart 414, Pascagoula Harbor, Mississippi, has been published and is available for distribution. This new chart, at a scale of 1:20,000, includes Pascagoula Harbor, the new harbor at Bayou Casotte, the Mississippi Sound and Gulf approaches to the harbors, Horn Island Pass, and the channels dredged through the Sound. Priced at $1.00 per copy, the new chart is available from sales agents, district offices, and the Washington office of the Coast and Geodetic Survey.

Map Information

This department was inaugurated for the purpose of bringing to the attention of the members information pertaining to the availability of maps, surveys, etc., with particular emphasis on how such material can be procured. It is believed that through an interchange and dissemination of such information maximum benefits will accrue to the surveying and mapping profession.

—EDITOR

Topographic Maps

THE FOLLOWING quadrangle maps were published or became available for distribution by the U. S. Geological Survey between December 1, 1959 and February 29, 1960. The list includes newly compiled maps; revised maps on which contours and drainage usually are unchanged but the works of man are brought up to date; and series-converted maps which are 15-minute maps produced from four 7½-minute maps of the same area. The maps are new unless otherwise designated by numerical superscript.

The quadrangle name (in capital letters) is followed by the name of the county (in upper- and lower-case letters) that contains the place or feature for which the quadrangle is named.

All maps are available with or without the green overprint that indicates woodland. These maps show the shape and elevation of the land surface (represented by contour lines, printed in brown—except those marked with the letter (P), which are planimetric); water features (in blue); works of man, including cities, towns, and scattered habitations, schools, churches, railroads, roads and boundaries, place and feature names (in black); and woodland areas (in green). Principal roads are shown by a red overprint. In areas that have been covered by Bureau of Land Management surveys, townships and section lines are shown. The State rectangular coordinate and the UTM 1,000-meter grid systems are indicated in the margins of the maps. An information folder further describing topographic maps is available on request.

Standard quadrangle maps may be obtained for 30 cents per copy. A discount of 20 percent is allowed on orders amounting to $10 or more at the retail price; a discount of 40 percent is allowed on orders amounting to $60 or more. Orders should be addressed to the U. S. Geological Survey, Washington 25, D. C., (or Denver 15, Colorado, for maps of areas west of the Mississippi River).

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* Indicates 15-minute quadrangles; all others are 7½-minute quadrangles.
[1] Indicates a revised map.
[2] Indicates a series-converted map.
† Indicates availability in either a contour or a shaded-relief edition.
‡ Indicates preliminary black and white edition.

Alabama

BILLINGSLEY*—Autauga
ELMORE*—Elmore
PLANTERSVILLE*—Dallas
SUMMERFIELD*—Dallas
WETUMPKA*—Elmore

Alaska

BRADFIELD CANAL A-3*
BRADFIELD CANAL B-3*
KETCHIKAN B-1*
KETCHIKAN B-3*
KETCHIKAN C-1*
TANANA C-3*
TANANA C-4*
VALDEZ B-3*

Arizona

ELGIN*[2]—Santa Cruz
HOUSE ROCK SPRING*—Coconino
MESA*[2]—Maricopa
MT. HUGHES[1]—Santa Cruz
MOUNT WRIGHTSON*—Santa Cruz
SAINT DAVID*—Cochise
SUNNYSIDE*[2]—Cochise

California

AUBURN*[2]—Placer
BODIE*—Mono
BOLLIBOKKA MTN.*[1]—Shasta
CATHEDRAL CITY—Riverside
COLUSA*[2]—Colusa
FORT BRAGG*—Mendocino
HOPLAND*—Mendocino
LIVERMORE*[2]—Alameda
MODESTO WEST*—Stanislaus
PETALUMA POINT[1]—Marin
PINKHAM WELL*—Riverside
PORT CHICAGO[1]—Contra Costa
REDWOOD POINT[1]—San Mateo
SAN LEANDRO[1]—Alameda
TOWER PEAK*—Tuolumne
VALLEY SPRINGS*[1]—Calaveras

California-Nevada

BRIDGEPORT*—Mono
TRENCH CANYON*—Mono

Colorado

EAST PORTAL—Gilpin
EMPIRE—Clear Creek
FALL RIVER PASS—Larimer
GRAYS PEAK—Clear Creek
ISOLATION PEAK—Grand
KEYSTONE—Summit
LOVELAND PASS—Clear Creek
MONARCH LAKE—Grand
SILVERTON*[2]—San Juan
TELLURIDE*[2]—San Miguel

Connecticut

ESSEX[1]—Middlesex
UNCASVILLE[1]—New London

Florida

DEEP LAKE—Collier
DEEP LAKE SW—Collier
DUNNELLON*[2]—Marion
LEE—Madison
MADISON—Madison
MILES CITY—Collier
SAINT CATHERINE—Sumter
WAHOO—Sumter

Georgia

AUGUSTA WEST[1]—Richmond
AVONDALE[1]—McDuffie
BRUNSWICK WEST—Glynn
BUCHANAN*—Haralson
DALLAS*—Paulding
GROVETOWN[1]—Columbia
HEPHZIBAH[1]—Richmond
VILLA RICA*—Carroll

Hawaii

HONOKAA—Hawaii

Idaho

BENNETT MTN.*—Elmore
CHALLIS*—Custer
HOMEDALE—Owyhee
LANE*—Kootenai
LEMHI*—Lemhi
MARSING—Owyhee
MELBA—Canyon
NAMPA—Canyon
SAINT JOE*—Benewah
SUBLETT*—Cassia
TWIN PEAKS*—Custer

Idaho-Montana

GOLDSTONE MTN.*—Lemhi

Illinois

EQUALITY—Gallatin
HEROD—Pope
KARBERS RIDGE—Hardin
RUDEMENT—Saline

Illinois-Kentucky

SALINE MINES—Gallatin

Indiana

BROWNSTOWN—Jackson
CROSS PLAINS—Ripley
GRABILL—Allen
IONA[1]—Knox
MONROE CITY[1]—Knox
OSCEOLA—St. Joseph
SAINT JOE—De Kalb
SANDY HOOK[1]—Daviess
TERRE HAUTE[1]—Vigo

Indiana-Illinois

OAKTOWN[1]—Knox

Indiana-Ohio

HICKSVILLE—Defiance
WOODBURN NORTH—Allen

Iowa

DES MOINES*[2]—Polk

Kansas

BAXTER SPRINGS—Cherokee
BOLTON—Montgomery
COFFEYVILLE WEST—Montgomery
COLUMBUS—Cherokee
CRESTLINE—Cherokee
HALSTEAD—Harvey
INDEPENDENCE—Montgomery
MOUNT HOPE—Sedgwick
SEDGWICK—Harvey
ZIMMERDALE—Harvey

Kentucky

MIDDLESBORO NORTH[1]—Bell

Kentucky-Illinois

CAVE IN ROCK—Hardin

Kentucky-Ohio

ASHLAND[1]—Boyd

Louisiana

ALLIGATOR POINT—Orleans

Louisiana-Mississippi

ENGLISH LOOKOUT—St. Tammany

Maine

AMITY*[1]—Aroostook
MOOSEHEAD LAKE*—Piscataquis

Maryland

LAUREL[1]—Prince Georges

Massachusetts

MOUNT TOM[1]—Hampden
NORTH TRURO[1]—Barnstable

Massachusetts-Connecticut

ASHLEY FALLS[1]—Berkshire
SOUTHWICK[1]—Hampden

Michigan

BIG RAPIDS*—Mecosta
CROSS VILLAGE*—Emmett
FREMONT*—Newaygo
GLADSTONE*—Delta
GRANDVILLE*—Kent
GRANDVILLE—Kent
HESPERIA*—Newaygo
PENINSULA POINT*—Delta
RAPID RIVER*—Delta
SAND LAKE*—Kent
TWIN LAKE*—Muskegon
WAYLAND*—Allegan
WOOD ISLAND*—Alger
WOODVILLE*—Newaygo

Minnesota

APPLETON—Swift
COKATO*—Wright
CORRELL—Big Stone
GRACELOCK—Chippewa
GRACELOCK NW—Swift
GRACELOCK SW—Chippewa
HUTCHINSON*—McLeod
PENNOCK—Kandiyohi
SOLOMON LAKE—Kandiyohi

Mississippi

WOODVILLE*—Wilkinson

Montana

ARSENIC PEAK—Teton
BARR CREEK—Lewis and Clark
CASTLE REEF—Teton
CAVE MOUNTAIN—Teton
CIRCUS PEAK—Flathead
CRESCENT CLIFF—Flathead
DRUMMOND*—Granite
FELIX PEAK—Flathead
GARRISON*—Powell
GATES PARK—Lewis and Clark
GLENN CREEK—Lewis and Clark
HORSEHOE PEAK—Flathead
LAKE THEBOE—Teton
MOUNT BRADLEY—Flathead
NIMROD—Flathead
PATRICKS BASIN—Lewis and Clark
PORPHYRY REEF—Teton
PRETTY PRAIRIE—Lewis and Clark
QUINTONKON—Flathead
RED PLUME MOUNTAIN—Flathead
SAWTOOTH RIDGE—Lewis and Clark
VIPOND PARK*—Beaverhead

Nebraska

ALBION EAST—Boone
HOLBROOK—Furnas
MASCOT—Harlan
OXFORD—Furnas
ST. EDWARD—Boone
ST. EDWARD SW—Boone

Nevada

MOUNTAIN SPRINGS*—Clark
PINE GROVE HILLS*—Lyon
OVERTON*—Clark
WINNEMUCCA*—Humboldt

Nevada-Arizona

VIRGIN PEAK*—Clark

New Hampshire

LOVEWELL MOUNTAIN*[1]—Sullivan

New Hampshire-Vermont

CLAREMONT*[1]—Sullivan

New York

BROOKFIELD—Madison
CASSVILLE—Oneida
CASTILE—Wyoming
DANSVILLE—Steuben
DEXTER—Jefferson
EARLVILLE—Madison
EAST PHARSALIA—Chenango
GALLOO ISLAND—Jefferson
GILBERTSVILLE—Otsego
GUILFORD—Chenango
HOLMESVILLE—Chenango
HUBBARDSVILLE—Madison
MT. MORRIS—Livingston
NAPLES—Ontario
NEW BERLIN SOUTH—Chenango
NUNDA—Livingston
OSSIAN—Livingston
PIKE—Wyoming
PORTAGEVILLE—Wyoming
POTTER—Yates
PRATTSBURG—Steuben
PULTENEY—Steuben
RICHLAND—Oswego
SHERBURNE—Chenango
SONYEA—Livingston
THERESA—Jefferson
WARSAW—Wyoming
UNADILLA—Otsego

New York-Connecticut

DOVER PLAINS[1]—Dutchess

North Dakota

BAKER—Benson
CAYUGA—Sargent
CAYUGA NW—Sargent
DRAKE*[2]—McHenry
ESMOND—Benson
GENESEO—Sargent
HAMLIN—Sargent
HARLOW—Benson
HARLOW SE—Benson
HARLOW SW—Benson
LONE BUTTE—McKenzie
LONE BUTTE SE—Dunn
LONG X DIVIDE—McKenzie
OBERON*[2]—Benson
PETRIFIED LAKE—Pierce
TOKIO*[2]—Benson

Ohio

BOWLING GREEN SOUTH—Wood
FREMONT EAST—Sandusky
FREMONT WEST—Sandusky

Ohio-West Virginia

BELMONT—Pleasants
MARIETTA—Washington

Oklahoma

LAKE SAHOMA—Creek

Oregon

LENZ*—Klamath

Oregon-California

MERRILL*—Klamath

Pennsylvania
NEW CASTLE SOUTH—Lawrence
SHARON EAST—Mercer

Puerto Rico
MOCA[1]—Aguadilla
PUERTO REAL[1]—Mayaguez
SAN GERMAN[1]—Mayaguez

South Carolina
CAINHOY—Berkeley
FORT MOULTRIE—Charleston
FRIPPS INLET—Beaufort
JOHNS ISLAND—Charleston

South Dakota
ANDOVER—Day
ANDOVER SW—Day
CRANDALL—Day
LANGFORD—Marshall
LANGFORD SW—Day
PIERPONT—Day

Tennessee
EXCELL—Montgomery

Texas
BOB CREEK—Stonewall
BONUS—Wharton
CLEVELAND—Liberty
CLINT—El Paso
CLINT NE—El Paso
CLINT NW—El Paso
CLINT SE—El Paso
FORT BLISS NE—El Paso
FORT BLISS SE—El Paso
FOSTORIA—Montgomery
GARWOOD—Colorado
HELMS WEST WELL—El Paso
HUECO TANKS—El Paso
LAKE PAULA—Montgomery
NATIONS SOUTH WELL—El Paso
NAVASOTA—Grimes
SAN ELIZARIO—El Paso
SEVEN DIAMOND L CANYON—Stonewall
TIMPSON*—Shelby
VERNON*—Wilbarger
WESTCOTT—San Jacinto
YSLETA—El Paso
YSLETA NW—El Paso

Texas-Oklahoma
ELMER*—Jackson

Utah
ELK RIDGE 4 NE‡—San Juan
ELK RIDGE 4 SE‡—San Juan
MONTICELLO*—San Juan

Utah-Colorado
MONUMENT CANYON*—San Juan

Vermont
BARRE*[1]—Washington
BENNINGTON*[2]—Bennington
RANDOLPH*[1]—Orange

Virginia
ACHILLES[1]—Gloucester
APPOMATTOX*—Appomattox
BACONS CASTLE[1]—Surry
BENNS CHURCH[1]—Isle of Wight
COBHAM BAY[1]—Surry
DILLWYN*[1]—Buckingham
NEW POINT COMFORT[1]—Mathews
YORKTOWN[1]—York

Virgin Islands
FREDERIKSTED—St. Croix

Washington
BODIE MTN.*—Ferry
NEMAH—Pacific
SALMON RIVER*—Grays Harbor
SATUS PASS*—Klickitat
WHEELER*[2]—Grant

West Virginia
ALUM CREEK—Kanawha
BIG CHIMNEY—Kanawha
FAIRMONT WEST—Marion
GARRETTS BEND—Lincoln
MOUNT OLIVE—Mason
ROBERTSBURG*—Putnam
SCOTT DEPOT—Putnam
THORNTON—Taylor
WINFIELD—Putnam

West Virginia-Ohio
CHESHIRE—Gallia

Wisconsin
BRIGGSVILLE*—Marquette
CITY POINT* (P)—Jackson
NORTH FREEDOM*—Sauk

Wyoming
CONTINENTAL PEAK—Fremont
DEL MONTE RIDGE[1]—Fremont
ESSEX MOUNTAIN*—Sweetwater
MADISON JUNCTION*—Yellowstone National Park
NINEMILE HILL[1]—Fremont
NORRIS JUNCTION*—Yellowstone National Park
PACIFIC SPRINGS—Fremont
SCHOETTLIN MOUNTAIN[1]—Fremont
SUPERIOR*—Sweetwater
T L RANCH—Carbon
TWELVEMILE WELL*—Sweetwater
UPTON*—Weston
WHITE ROCK CANYON—Carbon

Wyoming-Montana
MAMMOTH*—Yellowstone National Park

In addition to the standard series of quadrangle maps, small-scale (1:250,000) maps of areas in the United States and Territories are being published and distributed. They may be purchased from the Geological Survey for 50 cents per copy. An index to the series is available on request.

Alaska
CRAIG†
IKPIKPUK RIVER†
KATEEL RIVER†
LOOKOUT RIDGE†
SITKA†
TALKEETNA

Arizona
FLAGSTAFF

Nevada-Utah
LUND

Utah
SALINA

Utah-Colorado
MOAB

Special metropolitan-area and vicinity maps of major United States cities are being published and distributed by the Geological Survey. These maps are prepared from standard 7½-minute maps at the scale of 1:24,000. Vicinity maps may be purchased from the Geological Survey for the prices indicated below.

SAN JUAN AND VICINITY (57 by 48 inches) $1.50.

State maps are also being published and distributed. These maps may be purchased from the Geological Survey for the prices listed below.

UTAH (base). (20½ by 25 inches) 1:1,000,000 scale. 20¢.

# Indicates that map does not show contours.

Lake Survey Charts

PUBLICATION of new editions of the following Lake Survey Charts has been announced by the United States Lake Survey of the Corps of Engineers, U. S. Army. Copies of these charts may be obtained from the U. S. Lake Survey, 630 Federal Building, Detroit 26, Michigan, at $1.00 per copy. Payment is required in advance by P. O.

money order or draft, payable to the Treasurer of the United States. A catalog showing the areas described below is available free upon request.

25.—Lake Ontario Chart. Thirty Mile Point, N. Y., to Port Dalhousie, Ontario, including lower Welland Canal, at 1 : 80,000 scale. Insets: Olcott, N. Y., and Wilson, N. Y., at 1 : 10,000 scale.
62.—St. Marys River. Lake Munuscong to Sault Ste. Marie, including Lake George, at 1 : 40,000 scale.
175.—Burlington Harbor, Vt., at 1 : 10,000 scale.
314.—Lake Erie Chart. Buffalo Harbor, N. Y., including Black Rock Canal, at 1 : 15,000 scale.
511.—Lake Huron Chart, South End. One mile north of Lakeport, Mich., to Head of St. Clair River, at 1 : 15,000 scale.

Copies of the following Lake Survey Charts may be obtained at 25 cents per copy. They do not show hydrography.

806.—North Lake, at 1 : 42,240 scale.
810.—Knife Lake, at 1 :42,240 scale.
811.—Eastern Part of Basswood Lake, at 1 : 42,240 scale.
813.—Crooked Lake, at 1 : 42,240 scale.
815.—Lac La Croix, at 1 : 42,240 scale.
817.—Sand Point Lake to Lac la Croix, including Crane Lake and Little Vermilion Lake, at 1 : 42,240 scale.
818.—Eastern Part of Namakan Lake, at 1 : 42,240 scale.
820.—Western Part of Namakan Lake, and Eastern Part of Kabetogama Lake, at 1 : 42,240 scale.
822.—Western Part of Kabetogama Lake, at 1 : 42,240 scale.

Public Land Survey Plats

THE FOLLOWING plats of public land surveys and resurveys were completed and accepted by the Bureau of Land Management between December 1, 1959, and February 29, 1960. The class or purpose of the survey is indicated. Copies of plats may be secured from the Bureau offices in the States or from the Director, Bureau of Land Management, Department of the Interior, Washington 25, D. C.

Alabama—Huntsville Meridian
T. 15 S., R. 4 E.—Survey of islands
T. 15 S., R. 5 E.—Survey of islands
T. 16 S., R. 4 E. (3)—Survey of islands
T. 17 S., R. 4 E. (4)—Survey of islands
T. 18 S., R. 3 E. (3)—Survey of islands
T. 18 S., R. 4 E.—Survey of islands

Alaska
U. S. Survey No. 3303B—N.W. addition Sitka Townsite (extension)

Alaska—Copper River Meridian
T. 17 N., R. 12 E.—Extension survey
T. 18 N., R. 11 E.—Extension survey
T. 18 N., R. 12 E.—Extension survey

Alaska—Seward Meridian
T. 20 N., R. 9 E.—Extension survey
T. 20 N., R. 10 E.—Extension survey
T. 20 N., R. 11 E.—Extension survey
T. 1 N., R. 1 W.—Extension survey

Arizona—Gila and Salt River Meridian
T. 5 N., R. 6 E.—Extension survey
T. 6 N., R. 5 E.—Extension survey
T. 35 N., R. 5 W.—Original survey
T. 36 N., R. 5 W.—Original survey
T. 12 N., R. 11 W.—Original survey
T. 1 S., R. 3 W.—Dependent resurvey
T. 1 S., R. 4 W.—Dependent resurvey

California—Mount Diablo Meridian
T. 19 N., R. 6 E.—Resurvey and subdivision of sections
T. 19 N., R. 13 W.—Resurvey and subdivision of sections
T. 21 N., R. 15 W.—Resurvey and subdivision of sections

California—San Bernardino Meridian
T. 3 N., R. 4 E.—Extension survey
T. 18 N., R. 5 E.—Dependent resurvey (part)
T. 4 N., R. 6 W.—Resurvey and subdivision of sections

Colorado—Sixth Principal Meridian
T. 15 S., R. 100 W.—Original survey

Florida—Tallahassee Meridian
T. 24 S., R. 25 E.—Resurvey and subdivision of sections
T. 3 S., R. 29 W.—Resurvey and subdivision of sections

Mississippi—Washington Meridian
T. 14 N., R. 1 E.—Dependent resurvey, Sec. 33

Montana—Principal Meridian
T. 1 N., R. 10 W.—Extension survey

New Mexico—New Mexico Principal Meridian
T. 29 N., R. 13 W.—Resurvey and subdivision of sections
T. 2 S., R. 1 W.—Survey of tracts
T. 18 S., R. 14 W.—Survey of tracts

Oregon—Willamette Meridian
T. 2 S., R. 6 E.—Resurvey and subdivision of sections
T. 18 S., R. 1 E.—Resurvey and subdivision of sections
T. 20 S., R. 8 W.—Dependent resurvey
T. 25 S., R. 7 W.—Resurvey and subdivision of sections

Washington—Willamette Meridian
T. 39 N., R. 35 E.—Dependent resurvey (part)

County General Highway Maps

THE FOLLOWING county general highway maps were received by the U. S. Bureau of Public Roads, Washington, D. C. during the period from December 1, 1959, to February 29, 1960. Copies of these maps are sent to the Washington office as part of the continuing cooperative Federal-State highway planning program, as they are completed or revised by the State highway departments.

Inquiries concerning prices and orders should be sent to the respective State highway departments and *not* to the U. S. Bureau of Public Roads.

Arkansas
FULTON
HOWARD
IZARD
LOGAN

Colorado
CLEAR CREEK
GILPIN
LARIMER

Idaho
POWER

Kansas
HASKELL
MARSHALL
McPHERSON
POTTAWATOMIE
RICE
RILEY
SCOTT

Louisiana
ACADIA
JEFFERSON DAVIS
ST. LANDRY

Michigan
BERRIEN
BRANCH
CALHOUN
CASS
HILLSDALE
JACKSON
KALAMAZOO
LENAWEE
MACOMB
MONROE
ST. JOSEPH
VAN BUREN
WASHTENAW
WAYNE

Minnesota
DODGE
FILLMORE
HOUSTON
MOWER

Missouri
AUDRAIN
BATES
MISSISSIPPI
RALLS
RANDOLPH
REYNOLDS

Mississippi
LAMAR
MARION

Nebraska
GARDEN

Nevada
EUREKA

North Dakota
BOWMAN
GRANT
OLIVER
SIOUX
STARK

Ohio
HARDIN
JACKSON
STARK

Oregon
HARNEY

South Carolina
BEAUFORT
COLLETON

Tennessee
GILES
MARSHALL
MOORE

Texas
ANGELINA
BASTROP
BLANCO
BURNET
CALDWELL
COKE
CONCHO
CROCKETT
DIMMIT-ZAVALA
EDWARDS-REAL
GILLESPIE
GLASSCOCK
HAYS
HOUSTON
IRION
KIMBLE
KINNEY-UVALDE
LEE
LLANO
MASON
MAVERICK
MENARD
NACOGDOCHES
POLK
REAGAN
RUNNELS
SABINE
SAN AUGUSTINE
SAN JACINTO
SCHLEICHER-SUTTON
SHELBY
STERLING
TOM GREEN
TRAVIS
TRINITY
VAL VERDE
WEBB
WILLIAMSON

Vermont
CALEDONIA

Wyoming
BIG HORN

Columbia River Charts

Chart 6164, Columbia River, Juniper to Pasco, Oregon-Washington, scale 1:20,000, is the first of a new series of charts of the Columbia River planned to extend coverage of that stream from The Dalles to Richland, Washington. The series will include charts 6158 to 6165, inclusive, and will cover Lake Celilo, formed by The Dalles Dam, and Lake Wallula, formed by McNary Dam. John Day Dam, between The Dalles and McNary, and Lake Umatilla will be charted upon completion of the dam and the filling of the reservoir. The charts in this series are designed for commercial and small-craft operations which have increased greatly since the creation of the two new lakes. Chart 6164 is available from sales agents, district offices, and the Washington office of the Coast and Geodetic Survey at the price of $0.50 per copy.

The Wild Zenith Sight

EDITOR'S NOTE.—The following is an abstract of an article entitled "Le Viseur Zenithal Wild," by General F. Ollivier, published in *Géomètre*—Revue des Geometres-Experts et Topographes Français—No. 3, March 1960, pages 139–144.

The instrument is being used for cadastral surveys from aerial photographs to correct the building lines for overhang of roofs, etc. The unusual feature of the optical system of the instrument is that it includes a vessel containing a liquid with a prescribed index of refraction. With the instrument in a vertical position, the surface of the liquid and the bottom of the container are both horizontal and the zenith focuses on the center of the reticle. When the instrument is tilted from the vertical the surface of the liquid remains horizontal, forming a wedge which acts as a prism to correct for the tilt and keep the zenith in the same spot on the reticle. The theoretical error introduced by replacing the infinitely distant zenith by a point 10 meters above the instrument is shown to be on the order of 1 mm. In normal operation, holding the instrument in the hand, a mean square error of about 2 cm., results for a height of 15 m., according to the author's experience.

The instrument is cylindrical, about 6 inches in length, with a horizontal eyepiece. It is attached to a rod, extensible to 1.5 m., in length by an adjusting ring, within which it can swing like a pendulum. In normal operation this rod serves as a partial support for the instrument, the latter being held and set with one hand while the other holds a meter bar to measure the distance to the wall. Over-all weight is less than one kilogram.

Comment and Discussion

LAND BOUNDARIES

L. W. MAHONE*—In the December, 1959, issue of SURVEYING AND MAPPING, on pages 495–497, Curtis Brown discusses a problem in land boundaries which arose in Wisconsin. As might be expected, he has definitely and correctly stated the technical aspects of the situation, and yet the discussion leaves me somewhat disturbed.

Any discussion of this type is always hampered because *all* the facts seem never to be set forth. It does seem definite that in 1869 the section was divided into quarter sections and fences marking these boundaries were built and these fences have been accepted ever since. Mr. Brown infers that these fences *probably* have become the property lines. Court decisions in the middle West would indicate this to be true. If these are property boundaries, the only usable section center is the fence intersection. A technically correct section center would be of no actual value.

There could be a question as to whether the center of the section *was* incorrectly located. Certainly the procedure mentioned by Mr. Brown is usually the correct one, but in the earlier instructions some peculiarities crept in. The sketch indicates that the surveyor found the center of the E-W and N-S dimensions. I have heard of this being done, but done, I believe, in error. However, I have not seen all the early instructions in Wisconsin, and I doubt if Mr. Brown has.

On page 107 of "Public Land Surveys" by L. O. Stewart, it is mentioned that the Surveyor General at St. Louis in 1856 said the center of a section lay midway on the line connecting E-W quarter corners. Some such erroneous instruction *could* have prevailed in Wisconsin for a while.

Even if the survey were erroneously made, it probably was an "honest error" and has been accepted for many years. Mr. Brown says: "Since the surveyor erred, it can be corrected. Age does not make an incorrect survey correct." Once again we have a matter of interpretation. Technically a correction is possible; practically, correction is not possible here.

Reference is made to the rather well-known "The Judicial Functions of Surveyors," by Justice Cooley of the Michigan Supreme Court. He says in part: "Of course nothing in what has been said can require a surveyor to conceal his own judgment, or to report the facts one way when he believes them to be another. He has no right to mislead, and he may rightfully express his opinion that an original monument was at one place, when at the same time he is satisfied that acquiescence has fixed the right of the parties as if it were at another. But he would do mischief if he were to attempt to 'establish' monuments which he knew would *tend to disturb settled rights.*"

In making hundreds of property surveys in northern Iowa, I have run into many similar problems. Any attempt to correct the multitude of past mistakes would result in utter confusion.

* Professor, Department of Civil Engineering, University of Arkansas, Fayetteville, Arkansas.

INSTRUCTION FOR LAW STUDENTS

JOHN C. PAYNE*—Thank you very much for your letter and the copy of "Technical Standards for Property Surveys." I had already received several copies of the latter from Mr. Dix. I will be able to use all these copies but will not require more at present.

They should be very helpful in certain classes I am teaching. When I was in practice I knew nothing of the problem of locating land and my practice was the poorer for this ignorance. I am trying to make up this now by telling my students some of the problems they will face. Although property lawyers and surveyors are very much dependent upon each other I don't think either knows too much about what the other is doing, although if I were drawing comparisons I would say that the lawyers are more ignorant than the surveyors. In any event, I am trying to get together what scattered materials exist and are available for students. Your contribution will be most helpful in this effort.

* Professor of Law, University of Alabama, University, Alabama. A letter addressed to ACSM Past President Sol A. Bauer, 1836 Euclid Avenue, Cleveland 15, Ohio.

News of Related Organizations

California Council of Civil Engineers and Land Surveyors' president elect Walter J. Hanna, Jr., *left,* receives the gavel of office from past president Lee Scott. Other new officers are *from left to right:* Charles Christiansen, first vice president; Harold Musser, second vice president; Hanna and Scott; and William Pafford, secretary-treasurer.

East Bay Council on Surveying and Mapping

At its meeting of January 20, 1960, the East Bay Council on Surveying and Mapping, an ACSM affiliate, heard reports by chairmen of various technical-report committees on "Coordinates in Deeds and on Maps," "Analytical Method of Adjustment of Control Stations," and a progress report from the Special Methods Committee.

Clarence Walker reported on the horizontal and vertical control networks in the city of Fremont; Bruce Grant spoke concerning USC&GS specification changes for first- and second-order triangulation; Reuben Hurd discussed the readjustment of USC&GS bench marks, and James Carter staged a discussion and demonstration on the use of the Geodimeter.

Association of Ontario Land Surveyors

The 68th Annual Meeting of the Association of Ontario Land Surveyors was held at the Sheraton-Connaught Hotel in Hamilton, Ontario, February 15 to 17, 1960. The meetings were ably chaired throughout by President Raymond F. Mucklestone, a member of ACSM Property Surveys Division's Map Filing Committee for the past year.

Over 250 surveyors, many accompanied by their charming ladies, registered for the meeting—the largest registration of record. Extensive committee reports, each followed by spirited discussion from the floor, were complemented by an extremely complete social program.

The high point of the program, from a professional point of view, was the action taken by the membership following the extremely fine report of the Education Committee's Chairman, J. G. Pierce. These actions were: first, to request that the Council of Management begin immediate negotiations with Ontario universities to expedite a four-year degree course in surveying; second, to formally state that when such a curriculum was available, completion of the course would constitute primary evidence of qualification as an Ontario Land Surveyor; and, third, to considerably tighten the Association's control over its member-articled apprentice relationship until such time as the university course becomes available.

Other outstanding reports were rendered by the Land Surveying Committee, W. D. Ratz, Chairman, and by the Committee on Control Surveys, P. A. Monaghan, Chairman.

T. J. Blachut, Director of the Photogrammetric Section of the National Research Council, presented a definitive paper on "Legal Survey Practises in Continental Europe."

On Tuesday, February 16, those in attendance participated in a tour of the mills of the Steel Company of Canada, second largest on this continent.

Your reporter found the deliberations of the entire meeting to be of extremely high professional character, and considers the organization of the Ontario Association to be a model for surveyor groups in this country to carefully consider.

—A. PHILLIPS BILL
Chairman, PSD of ACSM

Anne Arundel Society of E. & L. S.

The annual meeting of the Anne Arundel Society of Engineers and Land Surveyors was held during the evening of Tuesday, January 26, 1960, with President Theodore Pantaleo presiding. Twenty-three persons were in attendance—fifteen members and eight prospective members.

Mr. J. J. Salovaara, Anne Arundel County Business Manager, gave an interesting talk on new administrative procedures and activities. He presented statistics on counties throughout the country having Business Manager County Commissioner type of government.

Following the usual routine business and committee reports, the Nominating Committee made its report, and the following officers and directors were elected:

President—Fayette M. Latham, Jr.
Vice President—Edward Hall
Secretary—John T. Latham
Treasurer—Ralph Snyder
Director—(3-year term) Thomas Shives. Holdover directors are John Boutwell, Raymond Harrington, and Theodore Pantaleo (ex-officio).

Mr. Latham was then installed as the new President.

—John T. Latham
Secretary

Association of Newfoundland Land Surveyors

The Seventh Annual Meeting of the Association of Newfoundland Land Surveyors was held at the Newfoundland Hotel on January 18 & 19, 1960, with President T. H. Winter presiding.

The Monday morning session included the address of the retiring president and a paper by Lt. Col. H. A. West of Ottawa on "Canadian Government Surveys in Newfoundland."

The afternoon session was given over to a lecture and demonstration by Mr. Keith Rosebrugh, General Manager, Tellurometer Canada Ltd., on the use of the Tellurometer. This portion of the meeting, which was thrown open to all interested persons and was attended by a number of students from the university, took up the greater portion of the afternoon.

At the dinner meeting in the evening, the Honorable W. J. Keough, Minister of Mines and Resources, was the guest speaker. The dinner was attended by about 100 members, their wives and guests.

On the morning of the 19th, papers were given by Dean S. J. Carew of the Faculty of Applied Science, Memorial University of Newfoundland, and by Mr. J. T. Allston, Director of Rural and Urban Planning, Department of Municipal Affairs and Supply. The first of these papers was followed by a lively debate on the education of the land surveyor. Mr. Allston's paper dealt with the various apsects of town planning.

At the afternoon session the following officers were installed, to serve for 1960:

President—James Canning
Vice President—N. R. Taylor
Secretary-Treasurer—G. T. Halley
Councillors—A. R. Penney, T. H. Winter, W. J. Walsh, L. Chaffey, and W. J. Nugent.

Note: The address of the retiring president, T. H. Winter, and the address of the Honorable W. J. Keough have been published in *The Newfoundland Surveyor*, January 1960, Vol. II, No. 1. (Mailing address for the Association and its Journal is: P. O. Box H-187, St. John's, Newfoundland.)

Florida Engineering Society

The Surveying and Mapping group of the Florida Engineering Society arranged for a strong program in connection with the 44th Annual Convention of the F.E.S., at Miami Beach, Florida, April 20–23, 1960. The Florida Engineering Society represents the professional engineers of Florida as the State chapter of the National Society of Professional Engineers.

The Surveying and Mapping program, Thursday, April 21, 1960, under the chairmanship of Jack Bennett, included the following papers:

"The Original Contracts and Instructions for General Land Office Surveys of Central Florida," by G. D. Wood, Secretary-Treasurer, Jones & Wood, Orlando,

"Qualifications for a Registered Land Surveyor," by Perry McGriff, Gainesville,

"Deed Descriptions vs Location on Ground," by Scott G. Stepp, President, Stepp, Wood & Associates, Inc., Titusville,

"Surveyor-Engineer-Architect Relations," by Russell H. DeGrove, Robert Angas & Associates, Jacksonville,

"Large Scale Photogrammetric Maps for Land Planning, by Jack M. Hires, Clyde Williams & Associates, Miami, and

"Application of Photogrammetric Flare Triangulation for Global Surveys," by Robert A. Kelley, Photogrammetrist.

Canadian Institute of Surveying

The Canadian Institute of Surveying held its 53rd annual meeting at the Chateau Laurier in Ottawa, on February 10–12, 1960. More than 600 members and friends registered. There was a large delegation from each of the provinces. Several from the United States were in attendance.

The President of the Institute, Armand Dumas, presided at most of the plenary sessions of the program which covered all fields of surveying and mapping. Rear Admiral K. St. B. Collins, Hydrographer of the Royal Navy; Rear Admiral H. Arnold Karo, Director of U. S. Coast and Geodetic Survey; and Mr. Harold J. McMillen, U. S. Geological Survey, were among the various administrators and engineers who contributed to the excellent program.

The hospitality of our Canadian friends is well known. The social activities which had been planned provided a means of creating fellowship and strengthening existing ties of friendship.

Cooperation Between BLM & CCofCE&LS

Service of a uniquely different type than ordinarily given members of professional organizations has been announced by William A. White, Executive Director of the California Council of Civil Engineers and Land Surveyors.

Regulations of the Bureau of Land Management make it obligatory for those using the original government notes on land surveys to pay for photostat copies of the notes prior to the time of delivery. This would be fine if the surveyor knew in advance how many copies would be necessary to provide the information, but, with this unknown factor to consider, much valuable time is lost between request and delivery and in determining the exact amount of material needed to accomplish the purpose.

For some time the Executive Director of the Council has been working with Mr. R. I. Adams of the Bureau of Land Management, and they have decided to put in operation a BLM-approved plan of deposit which can save as much as three weeks time. According to Mr. Adams, after the request for information is received, the Bureau must research the material and accurately determine the quantity of copies needed, write to the applicant, and wait for his reply and a remittance covering the legal fee for the work ordered.

A deposit in the name of the California Council of Civil Engineers and Land Surveyors is kept in escrow at the Bureau office. Members order the photo copies they need and draw against the deposit. No money actually changes hands, and the member of the Council pays a bill submitted by the Bureau at the end of each month, but the material ordered is delivered promptly. The original deposit was $100.00; but, with more than twenty orders a month to consider, it has been necessary to increase the deposit to a total of $500.00.

According to Messrs. Adams and White, this has proved to be a very satisfactory solution to a perplexing problem.

New B. L. M. Movie

"Alaska . . . Land to Grow On," a 28-minute sound and color film showing the public land and resource development programs of the Bureau of Land Management, is available for public distribution.

The new 16-mm. film was photographed amid the breathtaking splendor of Alaska's majestic mountains, vast untouched wilderness, and booming cities. The movie depicts BLM's role in past and future Alaskan development.

The movie covers BLM programs ranging from oil and gas leasing, through agricultural homesteading and townsite planning, to the heroic activities of BLM's smokejumpers who parachute onto raging forest fires as far as 300 miles from their base of operations.

The film is cleared for public-service television and is available to large or small groups. Schools, colleges, conservation organizations, and other interested groups may arrange a free-of-charge loan of the film or obtain additional information by writing the Director, Bureau of Land Management, U. S. Department of the Interior, Washington 25, D. C.

Our Public Lands

Congress News

ANNUAL DINNER, LOUISIANA SECTION, ACSM, MARCH 2, 1960

Louisiana Section

The annual dinner meeting of the Louisiana Section, ACSM, was held on March 2, 1960, in the Engineers Club of the DeSoto Hotel, New Orleans, Louisiana. Eighty-seven members and guests attended.

The principal speaker of the evening was Mr. Earl G. Thomas, Associate Director, Bureau of Land Management, Washington, D. C., who spoke to the group on the history and present functions of the Bureau of Land Management.

A special guest at this affair was Mr. Donald B. Clement, Chief Cadastral Engineer, Bureau of Land Management, Washington, D. C. Mr. Clement spoke briefly about the work now being done by his department in the western part of the United States and in Alaska.

R. S. BURNSIDE, JR.
Section Editor

Colorado Section

At its meeting of December 17, 1959, the Colorado Section, ACSM, elected the following officers for 1960:

Chairman—J. Loren Adams, 674 Clermont St., Denver 20, Colorado.

Vice Chairman—Louis S. Soreide, 618 Perry St., Denver 4, Colorado.

Secretary-Treasurer—Edwin O. Windham, 3655 Newland St., Wheat Ridge, Colorado.

Editor—A. G. England, U.S. Geological Survey, Building 25, Denver Federal Center, Denver, Colorado.

Committee chairmen appointed before February 15, 1960, are: Melville Harmel (Program) and Lester W. Ganahl (Membership). Roger Dwyer has been appointed Section Representative to the Convention.

The Colorado Section had a paid-up membership of 77 at the close of the year 1959.

—LOUIS S. SOREIDE
Vice Chairman

The March 1960 meeting of the Colorado Section, ACSM, was held March 31st in the U. S. Geological Survey Auditorium, Building 25, Denver Federal Center. Sixty-five members and visitors attended.

The meeting was called to order at 7:30 p.m., by Chairman Adams. Minutes of the December meeting were read and the Treasurer's report was given.

Mr. Adams then introduced L. F. Wylie, Projected Construction Engineer, Bureau of Reclamation, on the Glen Canyon Dam. Mr. Wylie gave an interesting talk on the surveying problems involved in the design and con-

struction of the dam. His talk was followed by the showing of an informative collection of color slides depicting the progress of construction and location of facilities at the Glen Canyon project.

Chairman Adams outlined plans for increasing the Section membership by stimulating local interest in ACSM.

E. O. WINDHAM
Secretary-Treasurer

A combined meeting of the Rocky Mountain Section, ASP, and the Colorado Section, ACSM, was held on April 19, 1960. The meeting was opened by Emmett J. Coon, Chairman, Rocky Mountain Section, who introduced Melvin A. Harmel, Program Chairman of the Colorado Section.

Mr. Harmel spoke of a joint dinner meeting to be held on May 3, 1960, at the Leyden Wickersham Post of the American Legion. At this meeting there is to be a lecture on Geologic Formations by Oren S. Childs, Director of Exploration Projects Group for Phillips Petroleum and President of the Rocky Mountain Association of Geologists.

Following the announcement of the dinner meeting, Mr. Coon turned the meeting over to James M. Lawson, who was to act as master of ceremonies. Mr. Lawson gave a resume of the Annual Convention of the ASP and ACSM in Washington, D. C., and then introduced speakers who attended the convention. The three speakers were: Warren Folz, Falcon Air Maps; H. M. Townsend, U. S. G. S.; and Roger Dwyer, U. S. G. S.

Midway in the evening, a recess was called and those attending were treated to coffee and doughnuts. Freda Dole and Fredericka Simon were hostesses in dispensing the refreshments. The break gave everyone a chance to chat and get acquainted or reacquainted with members.

The Rolla, Missouria, Section of ASP contributed $100 to one of its members to attend the national meeting. In speaking of local sections, they were strongly urged to have interesting talks and good social programs to stimulate interest.

After the speakers had completed their talks, Mr. Lawson turned the meeting back to Mr. Coon, who then introduced Loren Adams, Chairman, Colorado Section, ACSM. Mr. Adams urged everyone to make a special effort to attend the joint dinner meeting on May 3, 1960. As Oren S. Childs is an interesting speaker this coming meeting promises to be very interesting.

A. G. ENGLAND

Oregon Section

The April 16, 1960, meeting of the Oregon Section, ACSM, was held in Whitcomb Hall, Oregon State College, Corvallis, Oregon, in conjunction with the School of Engineering. The first technical council, a joint venture of the Oregon Section and Oregon State College, was called to order at 10:30 a.m., by Chairman Francis E. Waggoner. All present stood and introduced themselves. A good State-wide representation was shown.

Martin Coopey of the School of Engineering made a few brief remarks, one of them being that he hoped that this meeting would grow to be an annual affair. He then introduced John R. Oakes of the Oregon State Highway Department who showed slides and discussed the Lambert Coordinate System. A question and answer period followed.

Bruce Schminkey, chief surveyor for the City of Portland, then introduced Stanton Allison, Vice President and Chief Council for the Commonwealth Title Insurance Company, who spoke on the "Relationship Between the Surveyor and the Title Industry." Again a question and answer period followed.

After an intermission for lunch, the meeting was reconvened at 1:30 p.m.

Howard Buford, Planning Consultant from Eugene, Oregon, gave a very informative talk, with the assistance of slides, on the utilization of land.

The next speaker, an old friend to all of us in ACSM, was George C. Bestor, Past President of ACSM, from Carmel, California, who expressed his opinion that it was very gratifying to see the growth in the Oregon Section since its organizational meeting in Portland three years ago.

Mr. Bestor then spoke on his international travels and on the status of education of surveyors, and presented the A.S.C.E. report No. 2166. He asked the group to study it and see what they might resolve.

H. G. Chickering, Photogrammetrist, from Eugene, Oregon, talked on the advancements in his field, from the time of the pinhole camera to the modern equipment. Some new applications are the use of color photography to catalog timber types and motor scooters for speeding up the ground work.

At 3:40 p.m., Chairman Waggoner, Lane County Surveyor, called the meeting to a close, with a brief announcement that this would be made an annual affair. He also stated that the Annual Meeting of the Oregon Section, ACSM,

will be held in Eugene, Oregon, on September 24, 1960, at the Eugene Hotel.

CLAIRE E. PENSE
Secretary-Treasurer

Northern California Section

The first meeting of the year for the Northern California Section was held on February 19th at the University of California Extension Building in San Francisco. Fifty-seven members and guests from all over the Bay Area and from as far away as Redding, Oroville, Lower Lake, and Lodi attended the meeting.

Chairman Paul J. Dowling opened the meeting with the introduction of Directors C. M. Harrington and R. W. Brougher, and announced that future meetings through the year would be held at various places in Northern California so that all members and other interested people would be able to attend some of the meetings without traveling long distances.

The features of the evening's program, arranged by James Brennan, were two papers on distance-measuring devices. James Carter demonstrated and explained the uses and accuracies of the Geodimeter, giving results and relating experiences of his work with the State Highway Department, in private practice in New Mexico and California, and in measuring for the rapid-transit tube under San Francisco Bay. William Robinson, who is with R. M. Towill, Inc., in San Francisco, explained the Tellurometer and related his experiences with its operation in various Pacific Islands. He offered suggestions for surveyors and engineers who might desire to contract for traverse work to Tellurometer-owning firms. To those not familiar with the capabilities of these instruments, some of the traverse closures described by both speakers were astounding.

—CHARLES E. RANDLETT
Secretary-Treasurer

North Carolina Section

The annual meeting of the North Carolina Section, ACSM, convened at 3:30 p.m., January 22, 1960, at the Sir Walter Hotel in Raleigh, N. C., with First Vice Chairman Jerry R. Mitchell presiding. This was a joint meeting with the Property Survey and Mapping Functional Section of the Society of Professional Engineers of North Carolina.

C. C. Tilley reported on the recommendations from the Section Committee to the State Board of Registration in December 1959 for material to be included in the "Manual of Surveying Practices."

Secretary Cox reported on Section activities for the period from June 19 to December 31, 1959.

Due to his working out of the State, Edgar H. Kimmons requested that he be replaced on the Board of Directors. J. W. Bradfield, Jr., was appointed by the Chairman to fill the unexpired term.

E. P. Fitts and George Losak were unanimously elected to serve two additional years on the Board of Directors.

The following officers were elected:

Chairman—Jerry R. Mitchell, P. O. Box 1802, High Point, N. C.

First Vice Chairman—Benjamin L. Smith, Jr., 1414 Westover Terrace, Greensboro, N. C.

Second Vice Chairman—Lee M. Hinshaw, 234 W. Liberty St., Winston-Salem, N. C.

Treasurer—Fred B. Davis, 148½ Brevard Court, Charlotte, N. C.

Secretary—W. Thompson Cox, P. O. Box 178, Gastonia, N. C.

—W. THOMPSON COX
Secretary

Utah Section

At its annual business meeting, the Utah Section, ACSM, elected the following officers for 1960:

Chairman—H. P. Lee, Aero Service Corporation (Western), 35 Richards St., Salt Lake City, Utah.

Vice Chairman—Von G. Adamson, General Office Supply Co., 65 West Third South, Salt Lake City, Utah.

Secretary—Clifford G. Bryner, Annex 242, University of Utah, Salt Lake City 12, Utah.

Editor—Lamar P. Smith, 904 East Seventh South, Salt Lake City, Utah.

Personals

Joseph P. Dunich, Chief, Instrument Approach and Landing Chart Section, Aeronautical Chart Branch, Chart Division, Coast and Geodetic Survey, attended a two-weeks Flight Inspection and Procedures Training Course in Oklahoma City conducted by the Federal Aviation Agency Aeronautical Center.

Jon S. Beazley, Member of ACSM's Advisory Council, was recently elected president of the Big Bend Chapter of the Florida Engineering Society. This chapter covers 13 Florida coun-

ties and includes approximately 325 engineers. This selection is indicative of another step toward recognition of surveying and photogrammetry. The new president has been actively engaged in surveying and photogrammetry for over tweny years. Beazley is a professional civil engineer and has been a member of ACSM since 1946.

Walter J. Hanna, Jr., of Gilroy, California, was elected president of the California Council of Civil Engineers and Land Surveyors at its annual convention in Sacramento, January 21–23, 1960. Mr. Hanna was president of the Monterey Bay Chapter of the Council in 1958 and 1959 and chairman of its State Legislative Committee for two years. His election to the top office of the Council culminates several years of outstanding service to this statewide organization. Other officers elected to serve the council for 1960 are: **Charles W. Christensen,** San Diego, first vice president; **Harold Musser,** Nevada City, second vice president; and **William Pafford,** Los Angeles, secretary-treasurer.

Past President **George C. Bestor** spoke at the April 16, 1960, meeting of the Oregon Section, ACSM, at Corvallis, Oregon.

Walter S. Dix, Executive Secretary, ACSM, spoke at the annual meeting of the Louisiana Section, at New Orleans, Louisiana, on May 10, 1960.

Rear Admiral **H. Arnold Karo,** President of the ACSM and Director, Coast and Geodetic Survey, dedicated the Survey's new magnetic observatory at Ewa Point, Oahu, Hawaii, on June 23, 1960. He was also scheduled to speak before the Hawaii Section of the ACSM at about that same date. (*See* "New C. & G. S. Observatory at Honolulu," SURVEYING AND MAPPING, Vol. XIX, No. 2, June 1959, page 300.)

Professor **Arthur J. McNair,** Civil Engineering, Cornell University, has been elected Vice President of the American Society of Photogrammetry.

Lockwood, Kessler & Bartlett, Inc., Syosset, N. Y., consulting engineers, was admitted to listing and trading on the American Stock Exchange, April 11, 1960. **Ford Bartlett** is president of the company.

Captain Carl I. Aslakson, Coast and Geodetic Survey (Retired) was awarded the Boyden Premium by the Franklin Institute at its stated meeting on March 16, 1960, "in consideration of his contribution to the measurement of the speed of radiation in space through the use of Shoran techniques and thereby as the first American to aid in establishing a new and significantly more nearly accurate value of 16 km. per second higher than the long accepted value."

Deaths

Ralph Peters Black, whose death was noted very briefly in SURVEYING AND MAPPING, Vol. XX, No. 1, March 1960, page 126, passed away at his home, 858 Oakdale Road, N.E., Atlanta, Ga., during the evening of Monday, January 18, 1960. He had been on a hunting trip the Saturday before and was planning ahead for some other events, including his 79th birthday party.

Professor Black was a native of Georgia, the son of Congressman and Mrs. Black, and received his schooling in Atlanta, Ga. He received his A.B. degree from The University of the South, at Sewanee, Tenn.

He began his engineering career with the Pennsylvania Railroad, working in the panhandle section of West Virginia and in adjoining portions of Ohio and Pennsylvania. He married Jeanette Browne of Pittsburgh, and the couple soon moved to Sewanee, where Mr. Black became the University Engineer and built some of the landmarks still revered at that institution.

During World War I, he served as a First Lieutenant with the 32nd Engineers, AEF, and remained active in the reserves until his retirement at the age of 70 years.

Mr. Black eventually joined the faculty of the Georgia Institute of Technology, remaining with that organization until his retirement.

He was a charter member of the Society of American Military Engineers; a charter and life member of the Georgia Engineering Society; a Fellow and life member of the American Society of Civil Engineers, and a past president of its Georgia Section; one of the organizers as well as a past president of the Georgia Association of Registered Land Surveyors; and was active in the affairs of ACSM. He was also a member of the Georgia Education Association, the Hub of the South Chapter of the Association of the U. S. Army, Delta Tau Delta fraternity, the Optimist Club, the Druid Hills Golf Club, and All Saints Episcopal Church.

Professor Black is survived by his widow,

the former Mrs. Enid McCann of Atlanta; a daughter, Mrs. John Y. Huber III, of Gladwyne, Pa.; two sons, Ralph P. Black, Jr., of Atlanta, and George Browne Black of Bryn Mawr, Pa.; and twelve grandchildren.

Interment at Gladwyne, Pa., following services at All Saints Church in Atlanta.

Word has been received at the Central Office, ACSM, of the death, March 15, 1960, of **Ernst Ewoldson,** 963 Grosvenor Place, Oakland 10, California. Mr. Ewoldson became a member of the American Congress on Surveying and Mapping in 1956, and he was Chairman of the Property Surveys Division of the Northern California Section.

John R. Dickens, in charge of the Chart Construction Division, U. S. Navy Hydrographic Office, since 1955, died as a result of a heart attack on February 20, 1960, at the age of 55 years. Mr. Dickens received a degree in civil engineering from George Washington University in 1935 and served with the Hydrographic Office from that time until his death.

Word has also been received of the death, on March 4, 1960, of **John R. Pelletreau,** of Patchogue, Long Island, N. Y. Mr. Pelletreau was a member of the American Congress on Surveying and Mapping for many years and was also a member of the Nassau-Suffolk Civil Engineers, an affiliate of the ACSM.

Thanks to Annual Convention Committee

The American Congress on Surveying and Mapping expresses its praise to the 1960 ACSM-ASP Convention and Exhibit Committee and the Meetings Committee workers and participants, without whom the show would not have been possible. Thanks to all of you for a job well done. Special thanks to Convention Director Thomas A. Hughes and his worthy deputies and their wonderful teams, and to ACSM 20th Annual Meeting Chairman Granville K. Emminizer and his deputies and committeemen.

By order of ACSM Board of Direction
WALTER S. DIX
Executive Secretary, ACSM
March 23, 1960

PRE-CONVENTION MEETING 1960 ASCM-ASP CONVENTION COMMITTEEMEN

Left to right—Inside row: Margaret Christensen, Martha Forbes, Rupert Southard, Walter May, Walter Dix, Granville Emminizer, Roy Nunn, John McAlinden, James Small. *Second row:* Hilton Oglesby, Glenn Welden, Roger Graves, Walter Shea, Charles Schlager, Connie Moore, Charles Culkin, Thomas Hughes, Mrs. E. L. Marica, Robert Boisseau, Fane Pickering, Vance Rogers, Edward Russell, Abraham Anson, Mrs. Charles Juhre, Mrs. L. Raymond Smart. *Back row:* Lois Wall, Maria Rutscheidt, Mary Meyers, Frances Anspach, Barbara Greidel, William Moorhouse, Paul Alban, Joseph Bernard, Charles Theurer, W. S. Gasparovic, Anthony Sorrentino, Walter Seelig, Robert Gully, Michael Linck, Jr., Norman Brew, Charles Klotz, Hugh Loving, Charles Buckey, Lawrence Lambelet, and John Iverson.

EDITOR'S NOTE.—Several committeemen were not present when this picture was taken, and this key committee nucleus is expanded considerably during actual convention.

Apprenticeship Program

An apprenticeship program for the surveying industry has been set up by the California Council of Civil Engineers and Land Surveyors, Los Angeles Chapter, and the International Union of Operating Engineers, Local 12D, to relieve the serious shortage of trained surveyors in the Los Angeles area. The program has no known precedent in the West and will seek to train men engaged in field survey work for more specialized phases of surveying.

The importance of qualified surveyors to the building industry is often overlooked. Before a shovelful of dirt can be moved on any construction project, a survey must first be made to determine location, topography, boundaries, utilities, and structures. Designs for roads, subdivisions, industrial developments, and other municipal improvements are based on survey data.

The Southern California postwar construction boom has created a tremendous demand for surveyors which has not been met by schools, colleges, or independent on-the-job training programs. Employers have not been able to hire enough qualified men.

Management, labor, and a host of government agencies have long recognized the need for an apprenticeship program for the surveying industry, but not until August 1958 did a program originate as part of the 1958–59 Master Labor Agreement between the Council's Los Angeles Chapter and the International Union of Operating Engineers.

The agreement provided for a Joint Committee of labor and management to explore the possibilities of an apprenticeship program and to develop a set of standards acceptable to both parties. The Joint Committee enlisted the guidance and assistance of the California Division of Apprentice Standards to arrive at a workable program accredited by the State.

A questionnaire was developed and sent to the 1,500 union members engaged in field survey work in the 12 Southern California Counties to ascertain interest and willingness to participate in off-the-job training and study. Information collected is being assembled on a punch card system to assist in preparing courses, geographic location of classes, and reassignment of apprentices to keep training in proper order.

The Joint Committee prepared a list of on-the-job skills to be acquired through the apprenticeship program. These ranged from care of tools and equipment, safety practices, and note keeping to blueprint reading, job analysis, and specialized training in the various branches of surveying. Concurrently, a list was prepared of required academic studies to be taken at night classes or through correspondence courses.

The program should take an apprentice about four years to complete. Five grades have been established with time periods for each as follows: probationary apprentice, three months; apprentice chairman, six months; rear chairman, nine months; head chairman, eighteen months; party chief, twelve months.

The apprenticeship program has been divided into eight phases of surveying: land survey, subdivision, topographic, triangulation, construction, hydrographic, railroad, and mineral. In order to acquire the proper degree of proficiency the apprentice will be trained in only one phase of surveying.

The Joint Committee plans to begin the program in the field, placing apprentices under the tutelage of the present working force. The Division of Apprenticeship Standards pointed out that qualification and certification of the existing group of 400 party chiefs in the union had to be determined before training could be given under them.

Accordingly, the Joint Committee developed objective standards to qualify party chiefs, and examinations were prepared. To date (December 1959) 102 party chiefs were deemed qualified for the examinations. Forty-five of them took the examinations on October 17 and 24, 1959. A second examination was given January 9, 1960, to an additional 60 party chiefs.

The party chiefs who passed the examinations were honored at a dinner on January 16 at the Rodger Young Auditorium in Los Angeles and were awarded certificites of qualification by the Joint Committee.

Apprentice candidates may petition the Joint Committee to participate in the program. Plans called for the first classes in related academic instruction to begin March 1, 1960. If aptitude requirements are met, the candidates will enroll as probationers and advance over a four year period to certification by the State. On-the-job training under certified party chiefs has already begun.

The surveying industry of Southern California has demonstrated that labor and management can pool their efforts to pioneer a program which can only be a credit to both.

NEW MEMBERS

ACOSTA, Philip A., 1000 Springfield Ave., Irvington, N. J.—Casey & Keller, Civil Engineers and Surveyors

ADDISON, William Walter, Route 1, Box 243A, Convent, La.—Civil Engineer

ANDERSON, Ernest L., 23 Lee Ave., Clayton, Mo.—Cartographer, A.C.I.C.

ANDERSON, Gene E., Anderson Engineering Corp., 2549 East Broadway, Tucson, Ariz.

ANTHONY, David, 30 Drexel Drive, East St. Louis, Ill.—Geodesist, A.C.I.C.

AONA, Wilfred, 2520 Jasmine St., Honolulu 16, Hawaii—Land Surveyor, Department of Transportation

ARMFIELD, William E., 7145 Vrain St., Westminster, Colo.—Chief of Party; Meurer, Serafini, Meurer, Consulting Engineers

ARMSTRONG, Robert T., Jr., 44 Rae Ave., Needham, Mass.—Engineer, Pilling Engineering Co., Inc.

ASKEY, Robert L., P. O. Drawer 1267, Ponca City, Okla.—Engineer, Continental Oil Co.

ATHEY, Marvin, Imperial, Nebr.—Surveyor

BAEHR, Harry G., 1060 Homestead Ave., Walnut Creek, Calif.—President, B. T. Berndtson & Associates, Inc.

BAKKEN, Harold W., P. O. Box 916, Santa Cruz, Calif.—Civil Engineer, Frank Pisano & Associates

BANGS, Claude E., 107 St. Charles St., Rapid City, S. Dak.—Surveyor

BARD, Robert R., 4131 Davis St., St. Louis, 23, Mo.—Cartographer, A.C.I.C.

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HOOK, Robert W., 7628 Santa Monica St., Normandy 21, Mo.

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HOWARD, Roy, 551 El Paraiso Rd., N.W., Albuquerque, N. Mex.—Office Engineer, Ross-Beyer Engineering Office

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The Committee on Special Classifications of the Special Libraries Association and the Classification Committee of the Cataloging and Classification Section, Resources and Technical Services Division, American Library Association, are cooperating in a continuing project to develop and expand a Loan Collection of library classification schemes originally established by the Special Libraries Association. This collection covers all fields of science, law, medicine, technology, the social sciences and the humanities.

New libraries or libraries with special collections are constantly asking for classifications—in all areas of knowledge—and it is imperative that the Collection be kept up-to-date through the addition of new schemes or with modernized versions of existing classification schedules. Curators of special collections, special librarians, and those individuals who have developed special classification schemes for specific types of material or for special subjects are invited to contribute a copy of their work to the Collection. Classification schemes should be sent to: Dr. Jesse H. Shera, Curator, SLA Loan Collection, School of Library Science, Western Reserve University, Cleveland 6, Ohio.

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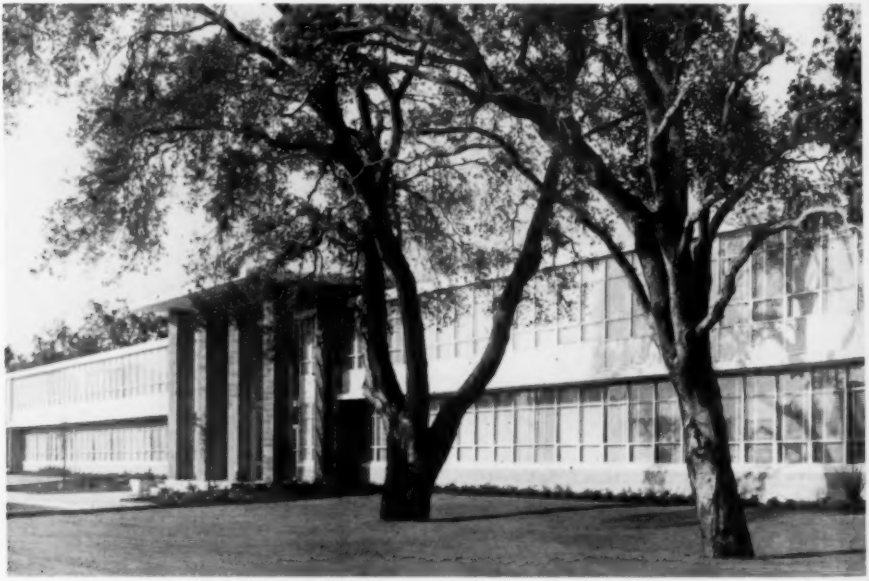
New U. S. Geological Survey Building at Menlo Park

Occupation and dedication of Building No. 3 at Menlo Park, California, which will house the U. S. Geological Survey's topographic mapping activities on the West Coast, brings the Survey's Pacific Coast Center another step closer to full operation. Buildings No. 1 and No. 2 (which are privately owned and leased to the Government) are occupied by units of the Geologic, Water Resources, and Administrative Divisions of the Survey.

Construction was begun on July 6, 1958, and the structure was ready for partial occupancy about a year later. It was functionally designed for the specialized operations and equipment to be housed there and was built at a cost of $1,025,000. Despite the utilitarian internal de-



U. S. Geological Survey

New building at Menlo Park, California, to house the U. S. Geological Survey's topograhic mapping activities in eight Western States. Dedicated November 24, 1959.

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sign the external appearance is in harmony with the community. Two stories high, 340 feet long and 138 feet wide, it contains some 85,530 square feet of floor space. The net usable area, exclusive of corridors and utility rooms. is approximately 63,000 square feet.

Exterior finish is light-brown concrete block, with aluminum windows and doors. Interior walls are painted plaster board, except certain walls that are of reinforced concrete to provide lateral bracing.

An air conditioning system is provided. Chilled water from refrigeration machines or hot water from a boiler is pumped to three fan rooms where circulating air is heated or cooled as required.

Electrical supply and illumination are provided to fit the specific work being performed. All illumination is fluorescent type except in the photographic-laboratory areas where incandescent lighting was chosen as more desirable. Light intensity in different rooms varies from 10 foot-candles, in certain areas used for specialized scribing operations which require subdued lighting, up to 100 foot-candles in areas requiring maximum illumination.

Photographic-laboratory rooms are provided with stainless steel sinks and custom-made cabinets sized to store required materials. A central blower system is installed for cooling the lamps in the stereoprojectors.

Moving the West Coast mapping operations from Sacramento to Menlo Park extended from June through September 1959. More than 200 tons of materials, equipment, and office furniture were moved—in addition to 150 families. The move was extended over four months to permit the scheduling of equipment and employee transfers with a minimum of loss of production. Fortunately, the completion of the construction and subsequent move coincided with the school-vacation periods of children of employees.

1961 ASP-ACSM Convention

The 1961 Consecutive Meetings and Co-Exhibits will be held at the Shoreham Hotel, Washington, D. C., during the week of March 19–25, 1961. In accordance with the long-standing practice of alternation of dates, the ASP will meet first next year from March 20–22, and the ACSM will meet from March 22–24.

Charles W. Culkin, 403 Orleans Circle, SW, Vienna, Virginia, has been named Director of the 1961 combined meetings, with Granville K. Emminizer scheduled to act as Assistant Director.

John M. McAlinden, Room 1015 Coast and Geodetic Survey, Washington 25, D. C., has been named Chairman of the 21st Annual Meeting Committee for the American Congress on Surveying and Mapping. Joseph P. Dunich, Room 3800, Coast and Geodetic Survey, Washington 25, D. C., will serve as Deputy Chairman of the same committee.

Southwestern Regional Conference

The Southwestern Regional Conference of the American Congress on Surveying and Mapping will be held as a joint meeting with the Ninth Annual Texas Surveyors Association Short Course at Austin, Texas, during the period October 10–13, 1960. All sessions of the meeting will be held on the mezzanine floor of the Hotel Stephen F. Austin.

Monday, October 10, will be devoted mainly to business sessions of the two organizations. The general sessions, at which time papers of local and national interest on surveying and mapping will be presented, begin at 9:00 a.m., Tuesday, October 11, and the meeting will close at 11:30 a.m., Thursday, October 13.

In the past, the attendance at the Texas Surveyors Association Short Course has averaged 300 members. With the added interest which will be created by the joint meeting, it is anticipated that the attendance this fall will be considerably increased.

In addition to the papers to be presented by speakers of national and local reputation, a full program of entertainment is being arranged for members and their wives. A cordial invitation is extended to all members of the American Congress on Surveying and Mapping, as well as other State surveyors organizations, to attend this meeting.

Further details can be obtained by contacting Mr. Joe Hicks, Chairman, Texas Section, ACSM, P. O. Box 1700, Houston 1, Texas; Mr. F. D. Smith, President, Texas Surveyors Association, P. O. Box 2025, Tyler, Texas; or Mr. V. A. Walston, Program Coordinator, P. O. Box 2180, Houston, Texas.

Now Hear This

Hunting Aerosurveys, Ltd., and Hunting Geophysics, Ltd., were amalgamated, as of January 1, 1960, as one opertaing company, Hunting Surveys Ltd., which will provide all the services to clients that were previously furnished by the two companies.

Dr. Ludwig Bertele, scientific collaborator of Wild Heerbrugg Ltd., received the Sherman Fairchild Photogrammetric Award at the 26th Annual Meeting of the American Society of Photogrammetry in Washington, D. C. Dr. Bertele is renowned for his development of wide-angle photographic systems, and the development of the Super Aviogon 120° lens was specifically mentioned in the citation. This photogrammetric award is sponsored by Fairchild Camera and Instrument Company and is conferred for practical inventions or designs involving equipment applicable to the art of aerial photography.

Norway's 103-year-old Geological Survey will move its headquarters from Oslo to Trondheim in 1961. The cornerstone of the new Kr. 4.3 million building was laid early in 1960.

The Florida Engineering Society has moved its headquarters office. The new address is 2517 East Colonial Drive, Orlando, Florida.

For their annual cookie-sale drive this year, the Girl Scouts of America used maps. Printed in green on parchment-like paper, the maps were not only decorative but helped to keep the packaged cookies nice and fresh. The maps were supplied by the Megowen-Educator Food Co.

A limited number of copies of the Proceedings of the Ninth International Congress of Surveyors, which was held at Scheveningen and Delft from August 28 to September 4, 1958, are available at the price of $6.00—or Hfl. 26.—each, plus mailing expenses. Orders should be directed to the Netherlands Foundation for the Organization of Surveyor's Congresses: S.O.L.C., p/a Uitgeverij Waltman, Hippolytusbuurt 4, Delft, The Netherlands. Orders should contain the name and address of the applicant in block letters. The book will be sent by return post together with an invoice.

EPIC Inc. (European Products Importing Company, Inc.) has available for distribution an interesting 8-page catalog of ARISTO Planimeters, Integrators, and Pantographs. Further information may be obtained from EPIC, Inc., 150 Nassau Street, New York 38, N. Y.

Fifth Century of the Death of Prince Henry the Navigator

The Government of Portugal has designated the period between March 4, 1960 (anniversary of the Prince's birth) and November 13, 1960 (anniversary of his death) to commemorate the fifth century of the death of Prince Henry the Navigator. Several aspects and features of the celebration are of particular interest to cartographers and geographers.

(1) The *Prince Henry Exhibition,* which will open in Lisbon on June 10th, will include a map section and will be a complete visual lesson on the History of Portuguese Discoveries.

(2) From September 4th to 12th, the *International Congress on the History of the Discoveries* will convene in the building of the Faculty of Letters, in Lisbon. More than 1,500 delegates, from various countries, are expected to participate in discussions concerning discoveries and the expansion of peoples and cultures throughout the world. The preliminary program of the Congress lists some 300 papers.

(3) Of significant and lasting importance are the several publications which are being prepared in connection with the commemoration. Historical cartographers are anxiously awaiting release of the magnificent five-volume work entitled *Portugaliae Monumenta Cartographica.* This outstanding historical, scientific, and artistic publication is being prepared under the editorial direction of two competent scholars, Dr. Armando Cortesão and Comm. Teixeria da Mota. The volumes will include reproductions (some in color) of some 1,600 early nautical charts and geographical maps, from the earliest dates through the seventeenth century. In view of its high value as an instrument of culture, sets of the *Portugaliae Monumenta Cartographica* will be distributed, by the Portuguese Government, to the world's principal historical and scientific institutions, libraries, archives, and educational institutions.

WALTER W. RISTOW

Orthophotoscope

A new instrument, the universal orthophotoscope, a photogrammetric machine that "flattens the mountains" to the satisfaction of mapmakers, was exhibited by the U. S. Geological Survey at the joint meeting of the American Congress on Surveying and Mapping and the American Society of Photogrammetry at the Shoreham Hotel, Washington, D. C., March 22–25, 1960.

In the new instrument, advantage is taken of the stereophotogrammetric principle to produce photographs that are free from image displacement due to camera tilt or topographic relief. The instrument represents the culmination of nearly a decade of research and development in the field of uniform-scale photography.

In the new model of the orthophotoscope, two overlapping aerial photographs are projected to form a three-dimensional image on a moving screen. The moving screen has a small slit in its center, and the light that passes through the slit strikes a photographic film.

The operator views the image on the screen and causes the screen and the film to raise or lower so that the slit skims the surface of the ground as it appears in the three-dimensional image. In this way, objects which are farther from the camera and therefore smaller on the original aerial photographs are enlarged more, and those objects which were closer to the camera and therefore larger on the original aerial photographs are enlarged less. The result is that the entire image pattern is brought to one uniform scale.

Orthophotographs are photomaps in the truest sense of the word and are valuable to mapmakers, geologists, foresters, land developers, agronomists, photointerpreters, and many others.

The 1960 universal orthophotoscope follows in the footsteps of the 1956 engineering model instrument. The experience gained in the design and fabrication of, and production with, that instrument proved to be invaluable in the design of the new and improved instrument.

Geographical Journal

The *Geographical Journal,* official publication of the Royal Geographical Society (London) has introduced a new section devoted to subjects of cartographic interest. The Editor of the *Journal* will accordingly be pleased to receive brief notes (350–500 words) on the activities of map-

(Continued on page 278.)

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Recommended Reading

For those interested in the matter of changing over from the English to the metric system in the United States, an editorial in *Science,* 22 January 1960, Vol. 131, No. 3395, page 193, might be worth reading.

Also, in *Science,* 19 February 1960, Vol. 131, No. 3399, page 503, column 3, "Metric Usage," is an abstract of the report of the chairman of the Committee on Metric Usage to the AAAS Council Meeting, 1959, on this same subject.

For those of our readers who are interested in engineering education, professional status, etc., we suggest a careful reading of "Engineers, Atomic Physics, and Mathematics," by E. R. Harrington, a member of the American Society of Civil Engineers, who is Director of Secondary Education, Albuquerque Public Schools, Albuquerque, N. Mex. The article appears in *Civil Engineering,* February 1960, pages 42 and 43.

"Surveyor or Surveyman? An important Distinction," *Civil Engineering,* April 1960, page 82—a letter to the editor of that publication by Walter S. Dix, Executive Secretary, ACSM.

Educators and others, interested in surveying and mapping instruction will find much of interest in *Bulletin on Surveying and Mapping,* which apparently is an 8-page separate from the catalog of The Graduate School, U. S. Department of Agriculture, Washington 25, D. C.

"The Lab Coat as a Status Symbol," the editorial in *Science,* Vol. 131, No. 3404, 25 March 1960, page 895, should be read following a rereading of "A Farewell to Boots and Stetson," SURVEYING AND MAPPING, Vol. XX, No. 1, March 1960, page 84.

Engineering News-Record, April 14, 1960, contains "ENR Special Report on Computers," by Frederick S. Merritt. This article, or series of articles, totalling about 13 pages, should be of considerable interest to anyone toying with the idea of buying or renting any electronic computer equipment.

Those who have struggled with the "alphabet soup" that has become so much a part of our language, both spoken and written, in the past two or three decades, will probably enjoy reading the editorial, "Claim to Fame," in *Science,* 6 May 1960, Vol. 131, No. 3410, page 1339.

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(Continued from page 276.)

ping institutions, and of important map libraries, as well as atlases and maps for review. It is hoped that the new section will provide in a convenient place a conspectus of international progress in cartography. If there proves to be sufficient demand, it is proposed to bind in one cover at the end of each year off-prints from the individual issues. The *Geographical Journal* is published quarterly by the Royal Geographical Society, Kensington Gore, London, S.W. 7. The subscription rate is $6.50 per annum, postage included.

WALTER W. RISTOW

A CORRECTION

In SURVEYING AND MAPPING, July–September 1958, Vol. XVIII, No. 3, page 329, column 1, 5th item, the scale of the map *The TVA Power System* was stated incorrectly. This map is at a scale of 40 miles to an inch or, approximately, 1:2,500,000.

Backsight

We are indebted to Professor Francis H. Moffit for the following gem. EDITOR.

The following question was propounded on an examination:

"Define the term *backsight* as it is used in the leveling operation."

The answer, given by a student of architecture, was:

"*Backsight* is found in the wye level and the dumpy level. It is a device, at the hinder part of the eyepiece, which when used in conjunction with the foresight is instrumental in removing errors of parallax. It is a round lens with horizontal markings in the telescope on the cross bars."

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